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Preparation of Lactic Acid.

Kiliani uses inverted sugar for making lactic acid. His method is as follows: 500 grammes of cane or beet sugar are dissolved in 250 grammes of water and 10 c. c. of dilute sulphuric acid added, and the sugar inverted by heating it to 50° C. (122° Fahr.) for three hours; neutralized with 400 c. c. soda solution (1 solid caustic soda to 1 water) added in portions of 50 c. c. each and cooled; warmed for a long time to 60° or 70° C. (140° to 158° Fahr.), until Fehling's solution is turned to faint green. Sulphuric acid (3 acid to 4 water) is run into the mixture when cold. After it cools again, a few crystals of Glauber salt are thrown in to make it crystallize. After 24 hours 93 p.c alcohol is poured over it, and the liquor exhausted with a filter pump. The alcoholic solution is put on a water bath and neutralized with carbonate of zinc, and after filtering is added to the other half. The lactate of zinc crystallizes out rapidly, and is purified by pressing or sucking out and recrystallizing. The yield is 30 or 40 per cent. of the weight of the sugar used. —*Chem. Zeit.*

LIFE-SAVING APPARATUS AT THE RECENT NAVAL AND SUBMARINE EXHIBITION.

We give engravings (for which we are indebted to the *Engineer*) of a variety of life-saving apparatus, shown at the recent Naval and Submarine Exhibition, London, England.

Figure 1 shows a "bridge life-boat," by John White, Medina Dock, Cowes. This life-boat is held on the bridge athwart ship, which consists of a launching way pivoting horizontally at the center, so that either end can be tipped down to the gunwale on either side when, the dog shores being struck, the lifeboat shoots into the water. Any water shipped is discharged through valves, and the boat is easily launched. The Orontes has long been fitted with this boat bridge, which has been so highly approved of that the system has been now adopted for the Tamar and Himalaya. This boat carries from 150 to 200 men Filled with water she would support 100.

Fig. 2 is Roper's life raft, forming a captain's bridge. Its weight is given as 5¼ tons, floating power 80 tons. It is intended to be self-launching on its fastenings being released. Mr. Roper has also self-floating raft decks for river boats. These simply rest by their weight in their place. If a vessel settled down in smooth water they are designed to float off with the passengers. A model of the ill-fated Princess Alice is fitted with decks which are calculated to support

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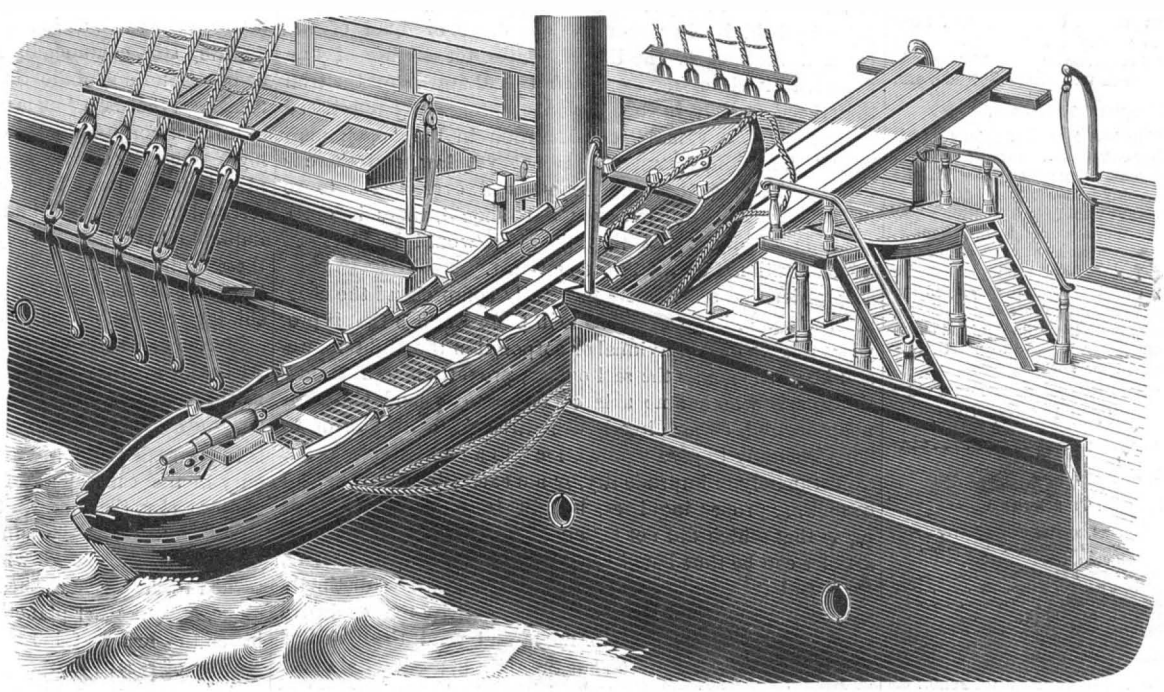
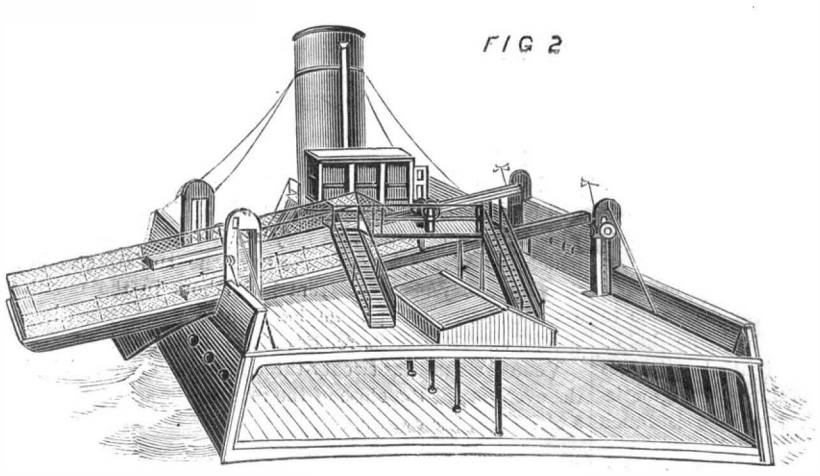
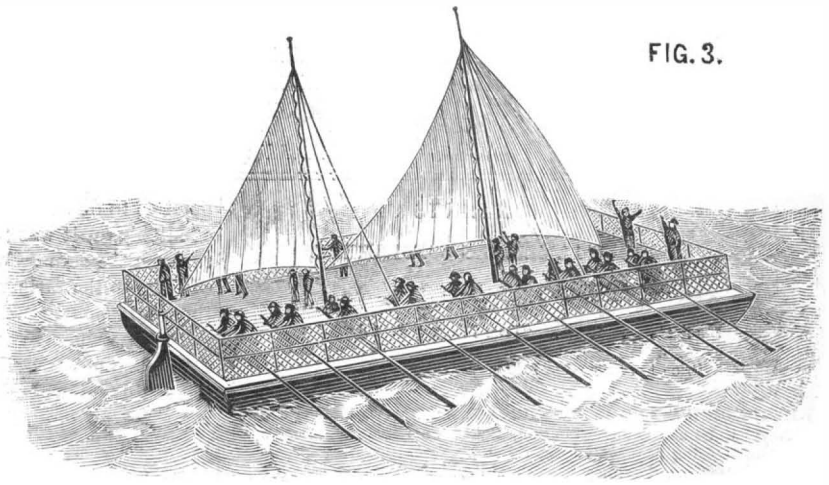


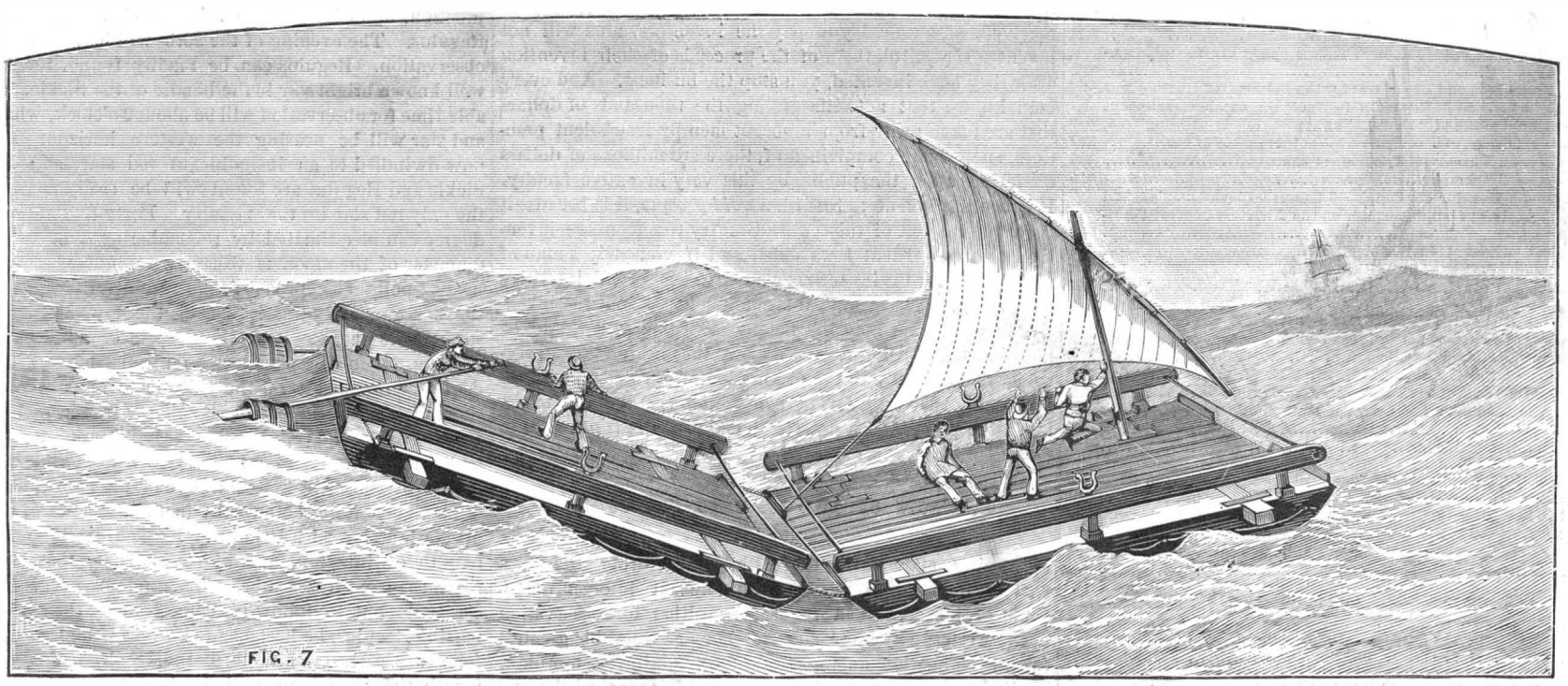
Fig. 1.—WHITE'S BRIDGE LIFE BOAT.



ROPER'S LIFE RAFT.



ROSE'S LIFE BUOY SEAT.



COPEMAN'S SEAT RAFT.

LIFE-SAVING APPLIANCES AT THE NAVAL AND SUBMARINE EXHIBITION, LONDON.

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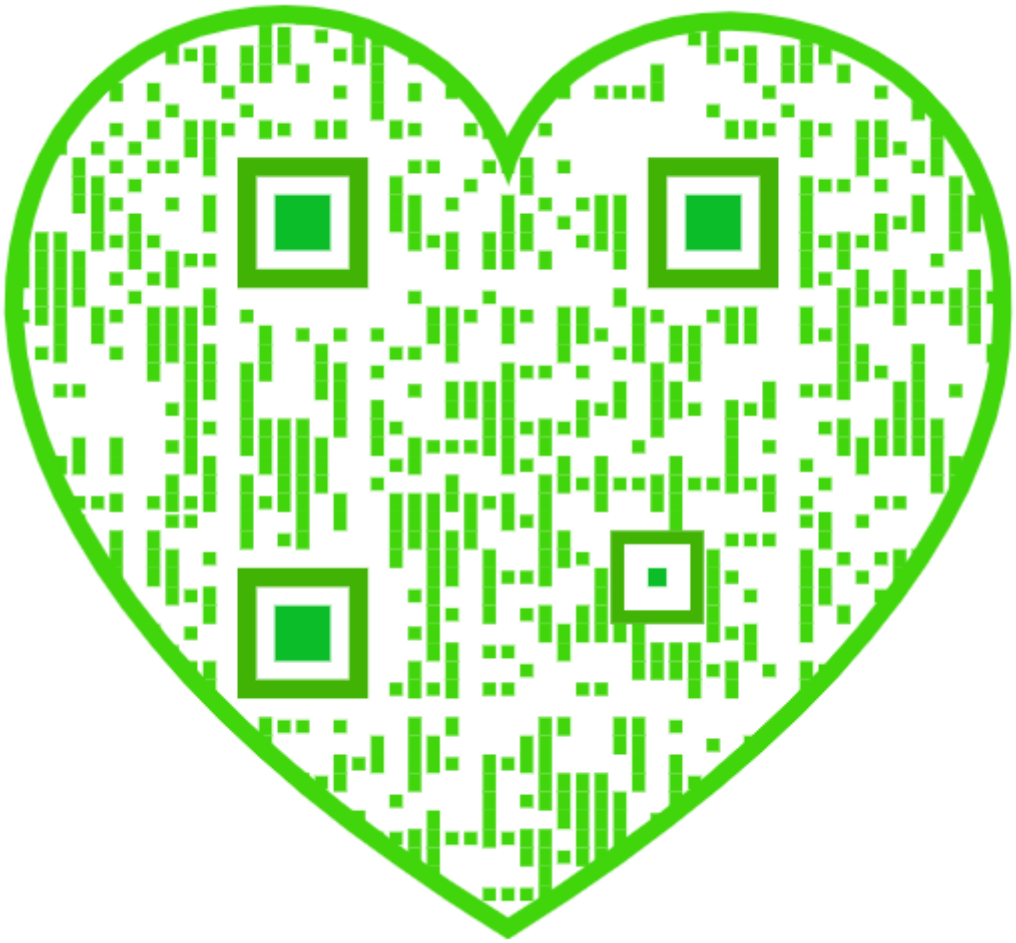

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NULLIFICATION OF THE PATENT LAWS.

Property, in law, has been defined to be the highest right a person has, or can have, to anything; and the labor of inventing, making, or producing anything is regarded as constituting one of the most indefeasible titles to property. Admitting this to be true, and that when letters patent are granted to an inventor he has a legal title given him for a specified term to the article or thing patented, which thus becomes his property, and that, in the words of the statute, an exclusive right is conferred upon him, his heirs, executors, and assigns, to "make, vend, and use" that which has been invented by him, it seems almost incredible that Congress should now attempt to put at defiance these plain principles of justice, and unblushingly assert itself the law-breaker as well as the law-maker, so far as the rights of inventors and patentees are concerned; nevertheless, such is literally the case.

A bill has recently passed the House of Representatives at Washington, nominally for the relief of innocent purchasers of patented articles, but virtually for robbing the patentee of the rights and privileges expressly awarded him by law. The bill reads thus: "That no action for damages or proceeding in equity shall be sustained, nor shall the party be held liable under Sections 4,919 or 4,921 of the Revised Statutes of the United States, for the use of any patented article or device, when it shall appear on the trial that the defendant in such action or proceeding purchased said article for a valuable consideration in the 'open market.'" This bill, fortunately, is not yet law, and there is little probability that the Senate will ever assent to so iniquitous a measure; but even if it should, there is not a question of doubt but that the law would be declared unconstitutional by the Supreme Court.

In order that our readers may fully comprehend the character of the bill, we would state in plain English that it proposes to give any individual or corporation the right to use and hold, as against the real owner, property bought from a third party who had no title or claim to it, and who was unauthorized, either directly or indirectly, to dispose of it. This is simply to give "protection" to a purchaser who has unfortunately, or imprudently, by not exercising due diligence or making proper inquiries, bought from an irresponsible party that which did not belong to the vender. If patented articles can be thus bought and held, so should real estate, for both have equal rights as property. The law distinctly gives a patentee or his legal representatives the exclusive right to use as well as to make and vend the patented article; and no other person has the right to use it without the patentee's consent, no matter whether he be an innocent or a guilty purchaser. Were it otherwise, how easily might innocency be assumed, and what latitude would be presented for the perpetration of fraud.

In the discussion of the bill, much stress was attempted to be laid by its advocates upon the purchasing in "open market" of the thing patented, as a ground of exemption from loss to the purchaser, and right to use and hold that which had been unlawfully sold; but when asked to define the term "open market," it was not found convenient or possible to do so. According to the theory of Mr. Burrows, of Michigan, it was "open market" for a set of men to go through the country with wagon-loads of gates and dispose of them to the farmers, who, after carelessly buying from these irresponsible dealers, find that they are amenable to the real owner by virtue of a patent which he holds. Denouncing these illegal venders and rightful patentees alike, this same gentleman concludes his tirade by stigmatizing them as insatiate vampires. Such language is much more emphatic than elegant or truthful.

We cannot do better than close these remarks by the following extracts from the speech of Mr. Reed, of Maine, who cogently though unsuccessfully opposed the bill: "The Constitution," said he, "has a right motive in protecting those men (the patentees), because the public get value received, and unless you pay the inventors, men will not invent. If you rob them of the proceeds of their invention after they have invented, you stop the business. And every man knows that notwithstanding the thousands of dollars that are taken away from innocent men by fraudulent practices, such as are complained of, there are millions of dollars conferred upon the public by this very inventive faculty. It is because inventors furnish a *quid pro quo*, it is because it is for the interest of this entire country to encourage invention, that the patent laws exist, and if you strip a man of his reward for his invention, you strip him of all incentive to exertion. What would this country be without the inventive faculty? Without the patent laws to-day it would be poor instead of being rich. We owe the cheapness of everything that enters into the production of our daily bread, of everything that we wear, of everything that we use, to the inventive power. Do not strike it down. It is not wise to do so."

ASPECTS OF THE PLANETS FOR JUNE.

MERCURY

is evening star until the 28th, and during the first part of the month possesses an unusual interest on account of his continued favorable position for observation in the western sky after sunset. He arrives at his greatest eastern elongation on the 1st, at 9 o'clock in the morning. He is then 23° 30′ east of the sun, and has reached the end of the invisible chain that binds him to the great luminary. His great northern declination, at present 25° 1′, makes it comparatively easy to find his position in the heavens, and makes him more conspicuous than when further south he attains his maximum distance 29° from the sun. He may be readily found on any clear evening for nearly two weeks to come, being now about 3° north of the sun, and setting an hour and three-quarters after the sun. Venus will be for a few nights a bright guide to her more humble companion, being a little distance to the southeast, and setting only a quarter of an hour after him. The paths of the two planets have however commenced to diverge. Mercury is retracing his steps toward the sun, setting earlier and losing his luster as he draws nearer to the magnet whose every impulse he blindly obeys. Venus is still traveling on her eastward course toward elongation, increasing in size and brightness as she increases her distance from the sun, while the proximity of the two planets lends for a few nights a notewortby interest to the long twilight glow of the serene summer night.

Mercury will fade into invisibility about the middle of the month, when his lesser light will be obscured in the sun's rays. On the 28th, at 1 o'clock in the morning, he is again close to the sun, reaching his inferior conjunction when he is at his nearest point to the earth, and, passing between the earth and sun, reappears on his western side as morning star, commencing again his oft repeated course. As he completes a synodic revolution in one hundred and fifteen days, that is, a journey from inferior conjunction round to inferior conjunction again, it is easy to follow his wanderings. Observers who keep up with the position of the planets from month to month cannot fail to be greatly interested in the bright stars with whose destiny our own is indissolubly united. They will soon learn to look upon these brother worlds with feelings of far deeper personal interest than those with which they regard the suns of space shining from measureless distances in the star depths.

Mercury sets now at a quarter past 9 o'clock in the evening. At the close of the month he rises about half past 4 o'clock in the morning.

VENUS

is evening star, and, after the brief companionship of Mercury in the early part of the month, reigns alone in the western sky, the undisputed queen of the starry throng. Almost as soon as the sun has disappeared, she hangs her golden lamp in the glowing west, and, wherever an eye is turned to the heavens, she is sure of an admirer. She reigns alone. No brother planets cross her track, no brilliant stars lessen the luster of her shining presence, and no incident worthy of record marks her progress. She moves on in her resistless course, lengthening the invisible chain that binds her to the sun as she travels on the long road that leads to her eastern elongation, all the time approaching the earth, and growing brighter and more beautiful as she draws near. Observers will involuntarily regard her with reverence as well as admiration, for with every reappearance she comes nearer to the grand event in her history, the transit of December 6th. This event is so universal in its interest, so intense in its importance, that millions of dollars will be expended for its observation, and the western hemisphere will be dotted with observatories where the men of science will assemble to watch every second of the time during which she makes her passage over the sun's face. Well, therefore, may she rest from her labors in the month of June, and serenely pursue her course without getting up special entertainments for terrestrial star gazers.

Venus sets now at twenty-three minutes after 9 o'clock in the evening; at the close of the month, she sets at half after 9 o'clock in the evening.

MARS

is evening star, and varies his monotonous course with an interesting event. On the 27th, at 2 o'clock in the morning, he is in conjunction with Regulus or Alpha Leonis, the leading brilliant in the constellation Leo. At the time of conjunction, Mars is forty-five minutes of a degree north of Regulus. The evening of the 26th will be the best time for observation. Regulus can be readily found, for it is the well known bright star in the handle of the Sickle. A favorable time for observation will be about 9 o'clock, when planet and star will be nearing the western horizon. Mars has now dwindled to an insignificant red star, and after the Sickle and Regulus are found will be easily recognized as the only red star in the vicinity. Forty-five minutes of a degree can be estimated by remembering that the average diameter of the moon is thirty-two minutes, although the nearest point of approach is not reached till Mars is below the horizon. Regulus is one of the few first magnitude stars whose path lies near the ecliptic or sun's path. It is not unusual for the planets who always move within eight degrees on each side of the ecliptic to approach within a short distance of the bright star that travels in their domain. Its nearness to the ecliptic—it is only half a degree distant—makes it useful to nautical observers for determining longitude at sea, and it is known as one of the nautical stars.

There is nothing noteworthy in the aspect of Mars except his conjunction with Regulus. He is traveling on his slow path to conjunction, and moves so lazily that he will not reach the sun till December. Therefore observers have little else to do but to follow his course among the stars. After passing Regulus, he hastens to overtake Uranus, while Venus follows closely on his steps, the result being that next month the monotony will be broken up, Mars passing Uranus, and Venus passing Uranus and Mars.

Mars sets about half past 11 o'clock in the evening; at

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the end of the month, he sets about twenty minutes past 10 o'clock.

URANUS

is evening star, and has traveled so far away that he is no longer visible except in the telescope. His course during the month is enlivened by an incident. On the 5th, at 3 o'clock in the morning, he is in quadrature with the sun, that is, he has reached his half way house between opposition and conjunction, being 90° from each. He is therefore on the meridian at 6 o'clock in the evening, and well advanced on his western path when the stars come out. His right ascension is 11 hours 4 minutes, and his declination 6° 50′ north.

Uranus sets a quarter before 1 o'clock in the morning; at the close of the month, he sets about 11 o'clock in the evening.

NEPTUNE

is morning star, and the first of the trio enjoying that distinction to emerge above the horizon. It will be remembered that he was in conjunction with the sun on the 6th of May, after which he passed to the sun's western side and became evening star. He is too far away to be seen even in the telescope at present. But the mental eye can pierce the depths of space, and behold the distant planet appearing above the horizon, and taking the lead of the morning stars as they herald the sun's near approach.

Neptune rises a few minutes before half past 3 o'clock in the morning; at the end of the month he rises about twenty-five minutes before 2 o'clock.

SATURN

is morning star, and keeps close to Neptune, there being but seven minutes' difference in the time of their rising at the beginning of the month, and ten minutes' difference at the close. His progress is entirely uneventful, though it is pleasant to think that he has turned the corner leading to opposition, and to imagine the superb aspect he will take on next November. He will begin to be an object of interest during the last part of June, for he rises nearly three hours before the sun. He may be found then in right ascension 3 hours 21 minutes, and declination 16° 20′ north, in the constellation Taurus, forming a triangle with the Pleiades and Aldebaran. Though at his most distant point, and in his smallest phase, he will soon change his aspect. Saturn rises now a little after half past 3 o'clock in the morning; at the close of the month he rises at a quarter before 2 o'clock.

JUPITER

is morning star and comes lagging along an hour after his brother planets. The Prince of Planets makes a forlorn appearance in his lessened size and diminished luster, hugging the sun so closely as to be entirely eclipsed during the first part of the month, and only faintly shining an hour before sunrise at its close. His path during the month is decidedly monotonous after the important part he has played for some months past. But all the planets cannot be leading actors all the time, and a season of rest will bring him out in radiant colors as the months roll on. It is unusual to have nothing to record concerning the movements of the planet upon whom so much attention is lavished when he is near enough for telescopic inspection. Never was a view of his returning face more ardently longed for, and never will the problems concerning the changes on his surface be more zealously studied than when he again draws near.

Jupiter now rises shortly before half past 4 o'clock in the morning; at the close of the month he rises at the end of the month at 3 o'clock.

THE JUNE MOON

fulls on the 1st. The waning moon is in conjunction with Neptune on the 12th, and with Saturn on the 13th. The waning crescent the day before her change is very near Jupiter, passing thirty-seven minutes south. The new moon of the 15th is in conjunction with Mercury on the 16th, and with Venus on the 18th. As Venus will be at the time more than six degrees north of the moon, the conjunction will not be of special interest. The moon passes near Mars on the 20th, and near Uranus on the 22d.

The telescopic material for planetary observation in June is not very satisfactory. Venus will, however, reward the patient observer, for while she retains her gibbous phase, less of her enlightened surface is turned toward us. She, however, more than makes up for the loss of light by her increasing nearness, and presents the seeming anomaly of steadily gaining in size and brilliancy as less and less of her illumined disk is turned toward the earth. Mercury may be studied with interest as he presents the phase of a waning moon in passing to inferior conjunction. Mars and Regulus at conjunction will be instructive objects for the telescope, the planet taking on the form of a ruddy disk with faint markings, and the star remaining a brilliant point of light. Even the largest telescopes can make nothing but points of dazzling light of the largest fixed stars on account of their immense distance.

In the scarcity of other objects the amateur telescopist can fall back upon the moon, which, in certain phases never loses her charm, and is seen to better advantage in a small telescope than a large one. The best time for a view of the moon is near or before the first quarter, when she is from three to eight days old, or under the same conditions during the last quarter. She is then superbly beautiful with her silvery light and curious markings, while her inner edge or terminator presents all manner of fantastic forms.

June is therefore a quiet month among the planets, in striking contrast to the prevailing activity of May. Our celestial neighbors have, however, greatly changed their position. Neptune, Saturn, and Jupiter reign in the morning sky, and anticipate the sun. Saturn and Jupiter will be charming to behold at the end of the month as they make their appearance when the morning light is breaking. The peerless Venus glows in the west throughout the month, and in the later portion reigns almost alone, Mars being the only other representative of the family. Those who watch the movements of Venus can see just how the earth looks when viewed from the planet Mars. Like her, she hugs the sun, oscillates eastward and back again, passes between the sun and Mars, oscillates westward and back again, and completes the circuit. Like Venus, she will, at long intervals make a transit. Martian astronomers, if there be any, will look forward to a transit of the earth as eagerly as terrestrial astronomers are looking forward to the transit of Venus in December. But Martian observers behold something more than our eyes can discern in looking upon Venus, for the earth, as she serenely pursues her course in the Martian sky, is accompanied by a tiny companion, our beautiful moon, transformed by distance from the grand proportions which we behold to a tiny point of light, revolving around the lovely evening star that glows in the Martian sky.

If planetary events are rare there is hope that the movements of the new comet will atone for the deficiency. Unless the men of science are wide of the mark the visitor in our northern sky will become an object of intense interest as, reaching perihelion, he looks down from high northern latitude, displays his shining nucleus, and spreads his gauzy tail over millions of miles of space, coming from unknown depths, and departing to unknown depths again.

CONGRESSIONAL ENGINEERING.

A bill was recently passed by the House of Representatives making an immediate appropriation of $50,000 for the work at Hell Gate, East River. In urging the passage of the bill Mr. Hewitt, of New York, said:

"The underground chambers are nearly ready for the final explosion, but in order that the rocks may be blown out of place this year, it is absolutely indispensable that the work should go on without interruption. If there be any interruption it will postpone the explosion for twelve months, for the reason that nitro-glycerine, which is the explosive agent used, can only be surely and safely exploded during a period of six weeks in September and October. During the summer the lightning which prevails at that time is apt to produce an inductive current, which may discharge the explosive compound; and during the winter the cold weather prevents the explosion altogether; so that any delay in the prosecution of this work will simply delay the entire work for twelve months."

Mr. Hewitt's statement of the case appears to have been convincing and conclusive, the successful explosion at Hallett's Point and the daily use of nitro-glycerine in mining and tunneling in all parts of the country to the contrary notwithstanding.

An Improvement in Ice Making.

Some months ago there was described and illustrated in this paper an important forward step in the economical production of ice artificially, in the binary absorption system, invented by the late C. M. Tessie du Motay and August J. Rossi. This system employed two liquids of unequal volatility, having great affinity, yet separable by reduction of pressure owing to the great volatility of one of them, its volatilization producing intense cold. The binary liquid was a mixture of sulphuric ether and sulphurous dioxide.

Recently Mr. Rossi and Mr. Leonard F. Beckwith, President of the International Ice Machine Company, have discovered that still better effects are obtainable by a mixture of ammonia and glycerine. The non-volatile glycerine absorbs at low pressure many volumes of ammonia; and when the ammonia is vaporized by the action of a pump, intense cold is produced. The chief advantage claimed for the new compound arises from the utilization of the great cold-producing power of the ammonia in volatilization, and the neutralization of its enormous pressure by its absorption in the glycerine. When the machine is at rest the pressure is from zero to 15 pounds, as against 125 pounds in the ordinary ammonia machine, and when the machine is at work the pressure is from 35 to 50 pounds, as compared with a pressure of 225 to 300 pounds in the ammonia machine.

The Faure Storage Battery on Shipboard.

The lighting of the steamship Labrador, on her recent passage from Havre to this port, by electric lamps supplied by Faure accumulators, marks an important stage in the practical application of stored electric energy.

The Labrador took on board at Havre 145 accumulators, said to contain 30,000 amperes of two volts tension. They were charged by a dynamo machine, April 29, and transferred the next day to the steamer, just before she sailed. Fifty of the batteries were placed in the engine room and were used in supplying the light aboard the steamer. Upon the arrival of the steamer at this port it was found that less than 500 amperes had been used, leaving the balance in good condition for future purposes. There were eight lamps kept continually lighted, six of "eight candle" power, one of six, and one of fifty candle light. The lamps used were those of the Edison, Maxim, and Swan lamps, the first named emitting the brightest light.

The accumulators were of two sizes, the larger containing the equivalent of the effective force of one horse power for one hour. The smaller were of about one-third that capacity. The larger batteries contain fourteen lead plates each, inclosed in a box about 20 inches by 8 inches by 12. The cost of electric lights on shipboard, supplied in this way, it is claimed, would be less than the cost of oil now used. The probable weight and cost of batteries for such use are not given.

The Effect of Bleeding on Inflammation.

The effect of local abstraction of blood in relieving local inflammation is one of the ancient doctrines of therapeutics which is still unrefuted and still unexplained. It was formerly held that the result was produced by a perfectly simple *modus operandi*. By the removal of blood from the surface the vessels of the deeper inflamed parts were partly emptied; but it was later recognized that this explanation is incompatible with the known conditions of the circulation. The local removal of blood never produces a lasting effect on the circulation in the part. At the present time it is generally assumed that the effect of local depletion is to remove the inflammatory stasis, although such an effect has never been demonstrated experimentally; and, moreover, the idea of a derivatory action still haunts the theory of the subject, while the effect is sometimes ascribed to the influence of the depletion on the whole mass of blood. The question has been lately subjected to experimental investigation by Genzmer and Nikolas, of Halle, and the results obtained have been described by the former in the *Centralblatt für Med. Wiss.* In the web of the foot of curarized frogs foci of inflammation were excited by punctiform cauterization, either by nitrate of silver or a red hot needle; and the process was watched with the microscope. When well known phenomena of inflammation made their appearance, the aggregation and exit of the white corpuscles, retardation of the blood current, and, finally, the formation of stasis, a leech was applied to the leg. As soon as the leech began to suck, a striking change occurred in the inflammatory process in the foot; the blood current became quickened, and carried on the corpuscles which were adherent to the wall. The stasis passed away, and in a few minutes the inflamed capillaries were cleared, and presented to the end of the experiment a normal and even accelerated circulation. Whether the corpuscles which had already wandered out of the vessels were influenced by the abstraction of blood could not be with certainty determined. In some experiments scarification was employed after the focus of inflammation had been excited. The effect was less conspicuous, since the loss of blood did not occur with the same vehemence as with a leech, although the amount of blood abstracted was nearly the same. The effect of abstraction of blood from the general circulation, by opening an abdominal vein, was still slighter, although the amount of blood taken was considerable. The conclusion drawn from these experiments is that the antiphlogistic action of local abstraction of blood is produced by a purely mechanical agency. A temporary augmentation of the circulation occurs, by which the capillaries are cleared; and the stasis, which is the first step in a local necrosis, is removed. Not only is no local anæmia produced, but there is actually an arterial hyperæmia; there is an increased supply of arterial blood to the focus of inflammation, which, besides its effect on the blood vessels, may reasonably be supposed to improve the nutrition of the tissues, and so to counteract the tendencies of inflammation. The antiphlogistic action is clearly proportioned both to the amount of blood withdrawn and to the rapidity of its withdrawal, and its action is notably greater if the blood can be withdrawn from the circulation between the region of the inflammation and the right side of the heart.—*Lancet.*

An Improved Stone Boat.

A correspondent of the *Country Gentleman* describes a novel form of stone boat in use in Monroe county, N. Y. Instead of having the boards composing the "boat" extend under the entire surface, and only slightly turned up at the forward end, the improvement is a stone sled, with runners six to eight inches broad, composed of two three-inch planks, sawed so as to give a rise of six inches or more at the front. On each of these runners is placed a piece of 3x4 inch scantling, and three lengths of the same four and a half feet long connect the two sides of the boat and form the platform on which good inch boards are laid. The whole is then spiked with wooden bolts extending through the bottoms of the runners. Wooden pins are better than iron, because as the boat wears, iron would tear up the soil. There need not be a particle of iron in the boat, if wide enough boards are used, though it is better to put in a few nails to hold down the center.

This form of boat is very strong, and can be used where an ordinary stone boat would be impracticable. It is decidedly improved by putting in a tongue so as to be more readily guided. With even the slightest fall of snow it is quite as convenient as a sled.

Rear Admiral John Rodgers, U. S. N.

In the death of Rear Admiral John Rodgers, in Washington, May 5, the United States Navy loses one of its oldest and most capable officers. He was lately President of the Naval Advisory Board, and for a number of years has been Superintendent of the Naval Observatory at Washington.

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TORPEDO BOAT FOR THE ITALIAN GOVERNMENT.

We annex engravings of a torpedo boat recently constructed for the Italian Government by Messrs. Yarrow & Co., of London. It is 100 feet in length by 12 feet 6 inches beam, dimensions which have been found by actual experience to give thoroughly sea-going qualities. As evidence of this it may be mentioned that two similar boats were navigated across the Atlantic last year as well as ten to the Mediterranean, all of which reached their destination in perfect safety.

It may be observed that the stability of these boats has on several occasions been carefully tested with a view to a reduction of beam so as to obtain finer lines and better speed, and it has been found the breadth of 12½ feet must be maintained to secure a range of stability necessary to make them thoroughly safe in any weather, which is clearly a primary consideration in a sea-going torpedo boat. The official trial of the above boat was made last December in the presence of the Italian authorities, when a mean speed, with torpedo apparatus all completely fitted on board, was obtained of 22·46 knots, which we believe is the highest speed hitherto officially recorded. The forward part of the boat is protected, as will be seen, by a turtle back terminating at its after end with the conning tower, an arrangement always adopted by the builder since they constructed the Batoum, which was the first boat of this class built. This turtle back is found of great value when encountering rough weather, at the same time giving very ample room for the working of the torpedo gear below.

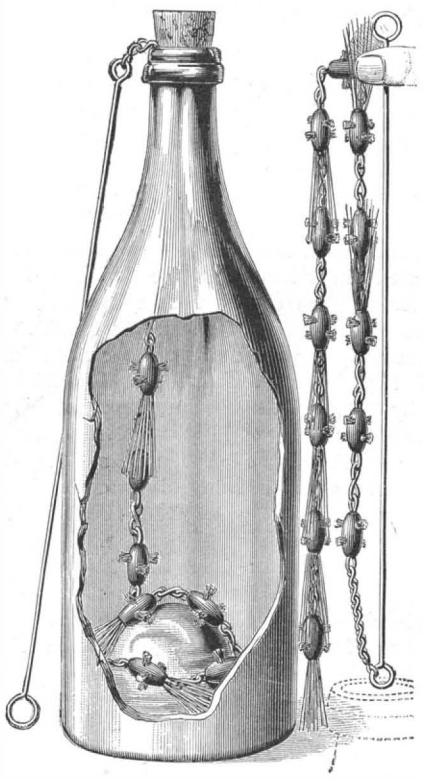
Messrs. Yarrow & Co. attach very considerable importance to the curvature of all the plates in the hull which may have to bear compression, a thin flat plate possessing but little strength to resist that strain; for this reason they invariably adopt a curved form of deck, the platform for walking on being along the central portion. The curved deck has the additional advantage of causing the water which may come over the boat to freely flow off.

There are two ejecting tubes, which are snugly housed under the turtle back, and the bow of the boat is so arranged that the forward ends of the tubes are completely inclosed within the vessel's lines, it having been found from experience that if the tubes project when the vessel is pitching the waves striking them cause a serious shock, as well as offering a greatly augmented resistance. This arrangement enables a man to get down in the fore peak and examine the tube ends, which otherwise it would be impossible to obtain access to.

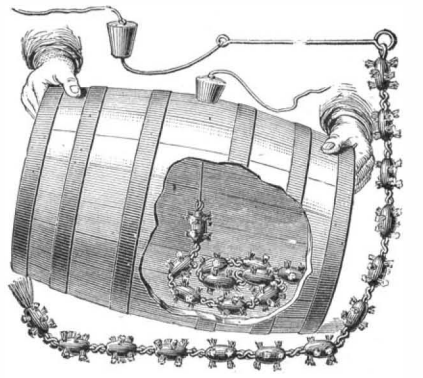
The steering of all these boats is effected by means of two rudders, one aft as usual, and one drop rudder forward, as originally introduced by Messrs. Yarrow & Co.; these are worked by steam, and under the control of the steersman in the conning tower. The upper part of the funnels are bent slightly aft, as shown, for it has been found that in very rough weather, when everything is screwed down tight, the only way the water can obtain access to the hull is down the funnels. This fact alone will give some idea of the boisterous weather which they have at times encountered. The engines, which are of 16 inches stroke, during the trial made 480 revolutions per minute, *i. e.*, 1,280 feet per minute, which our readers will be aware is an exceptionally high piston speed; nevertheless no sign of abrasion has ever been visible, which is the more remarkable considering that no oil under any circumstances is allowed into the interior of the engines, because even a very small quantity of lubricant finding its way into the boiler causes rapid deterioration and increases to a remarkable degree the amount of steam space necessary to avoid priming. The effect of even the smallest quantity of grease or oil as tending to cause priming was formerly exemplified to a remarkable degree in torpedo boats when it was the custom to use lubricants to the pistons and slide valves. It was found that the boiler when new and supplied with only fresh water, or, still better, distilled water, at first not showing the slightest indication of priming, would, after a few hours' continuous steaming (by which time a little grease could find its way through the condenser and feed pumps), commence priming to such an extent as frequently to bring a trial to a premature end.

This boat is the first which has been fitted with a patent arrangement for preventing the fire from being extinguished should water gain access to the stokehole or boiler compartment, which in face of the present machine guns is a contingency to be looked for. The arrangement is exceedingly simple but effective. The fact is the ash-pan is simply continued up round the sides of the firebox to above the sea outside, and secured watertight to the barrel of the boiler, the fire-door at the same time being tolerably water-tight.

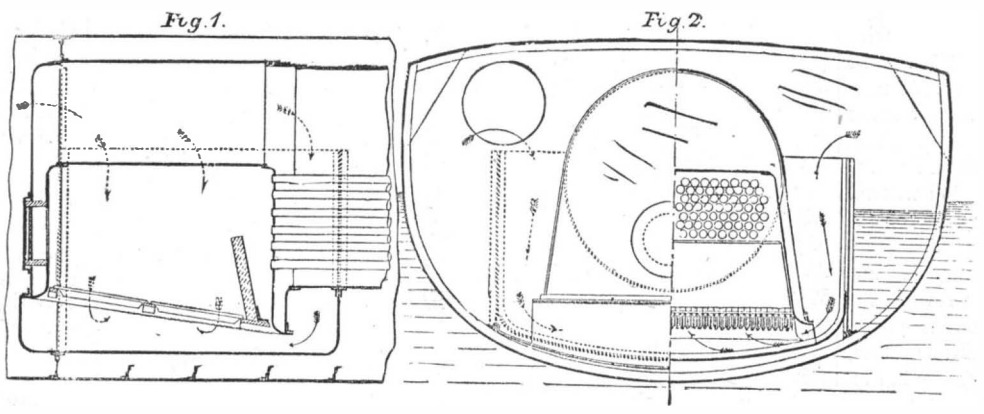
It will be easily seen that if the water gain access under ordinary circumstances to the stokehole or boiler compartment, it would not have many inches to rise before it would reach the level of the bars, which are kept as near to the bottom of the boat as possible, so as to avoid raising the center of gravity. It will be clearly understood with this new arrangement the water could rise up in the stokehole to the level of the sea outside, and still the fire would be untouched and the supply of air would likewise not be interfered with. The steaming power of the boat will therefore continue so long as the fire lasts, and as these boats when running have about 12 cwt. of fuel on their bars, and as it is found by experiment that 2 cwt. is sufficient to run an hour at a ten knot speed, it naturally follows that the steaming powers of the boat would enable it to run from forty to fifty knots under the conditions assumed; while, on the other hand, had this new arrangement not been provided, immediately the fire is extinguished the boat would be quite helpless, and the pumping power, which so long as there is a supply of steam is very considerable, would be stopped.—*Engineering.*

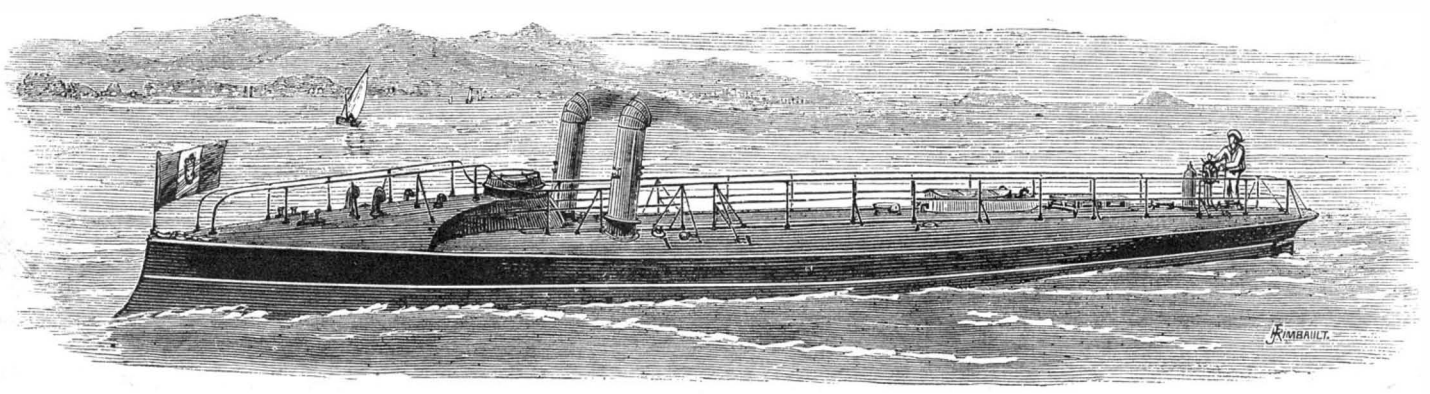


NEW BOTTLE CLEANER.



BARREL CLEANER.





NEW TORPEDO BOAT FOR THE ITALIAN GOVERNMENT.

NEW BOTTLE CLEANER.

We give an engraving of a bottle and cask cleaner, which is very simple and effectual. It has proved itself in actual practice to be capable of quickly and thoroughly cleaning bottles of all shapes and sizes, also jugs and casks. For very small vials the inventors have produced a special size of cleaner, which will economically clean vials from one-half ounce upward.

The cut represents the "rapid bottle cleaner" in use. This device is simple in its construction, and can be operated by any one. It fills a want long felt, and is valuable in family use as well as by the trade. It does away with the old and dangerous method of cleaning with lead shot, in which operation several shot will often fasten in the bottom of the bottle, and through neglect or trouble in getting them out be allowed to remain there.

The barrel cleaner is operated mainly in the same manner as the bottle cleaner described above. The balls are introduced through the bung without reversing, the bung closed with the stopper, and the barrel shaken as in operating with a chain. It is obvious that these balls, weighing a quarter of a pound each, and furnished with stiff brushes on all sides, will do the work thoroughly and effectively.

The bristles are forced by the weight of the balls into the smallest crevice of a barrel or the narrowest corner in the bottom of a bottle. No lead deposits need be feared from the device; the balls are made from a composition metal which will not corrode. The machines are especially useful in bar-rooms, apothecaries' stores, wholesale stores, and in all establishments where liquids or liquors are barreled or bottled.

The invention, as will be seen by reference to the engraving, consists of a series of metal balls or blocks connected together by links and provided with a series of bristle or wire brushes. One end of the chain of balls is connected with a rod, by which it is introduced and withdrawn from the bottle or barrel. The cleaning is effected by shaking the chain about in the bottle or barrel with water or some suitable cleaning fluid.

For further particulars in regard to this useful invention address Rapid Barrel and Bottle Cleaning Co., Rhinebeck, Dutchess Co., N. Y.

Process for Photo Printing Plates.

Mr. J. Traill Taylor, in a letter from New York to the *British Journal of Photography*, describes the following mode of making photo printing plates, practiced by Rev. H. Goodwin, of Newark, N. J.:

The leading feature in Mr. Goodwin's engraving process consists in a reversal of the methods hitherto employed, as will be seen from my description. Let us suppose that a metal plate—zinc, for example—is to be prepared for typographic printing; the surface having been polished is coated with sensitized albumen or gelatin and dried. It is next exposed to light under a transparency, not a negative. An engraving, a piece of music, or any drawing or pen and ink writing on a sheet of paper having nothing on the back may be reproduced by this method. This is then pressed into close contact with the plate, which is now exposed to light. It need scarcely be remarked that this operation will be greatly aided by first rendering the paper as transparent as possible, by some of the known means of doing so, in such a manner as not to affect it permanently—*e. g.*, sponging over with benzole or any of the volatile oils. Having been exposed, the plate is next inked and developed by water in the manner well known to workers in similar processes. The parts corresponding to the blacks of the writing are now seen to have been laid bare, all the whites being coated with the insoluble albumen and ink, which layer is strengthened and made acid-resisting by dusting powdered rosin upon the plate, the rosin adhering only to the inked portion. The surplus having been dusted off a sufficient degree of heat to just fuse the rosin is then applied. The plate is next dipped for about a minute in a dilute solution of perchlor-

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ide of iron in order to dissolve away all trace of albumen that may have been left on the surface on the portions that ought to be laid bare, and also to prepare such parts to receive the next application. This consists of a solution of asphalt in turpentine applied with a dabber of cotton wool, by which also the ink that previously covered the remainder of the surface becomes removed, leaving the albumen. This is followed by another application of the asphalt solution, after which the surface is inked, and then the plate is immersed in any solvent of light hardened albumen, such as dilute hydrochloric acid, which etches the plate. This latter operation is aided by the application of a tuft of cotton wool, which removes from the plate the loosened or partially dissolved albumen, leaving the surface better exposed to the action of the etching fluid. After such treatment the plate is ready for being printed from. Some impressions I have seen, produced by the process described, were quite equal to the original printing, which served as the *cliché*. By the substitution of a lithographic stone the process becomes a purely photolithographic process. When the plate is to be worked in connection with type, as in ordinary letterpress printing, the etching must be carried to a depth sufficient to protect the whites from the inking roller. If instead of a positive or a transparency, a negative be employed, the resulting engraved plate will be an intaglio suitable for being worked at the copper plate press.

NOVEL WINDOW BLIND OPERATOR.

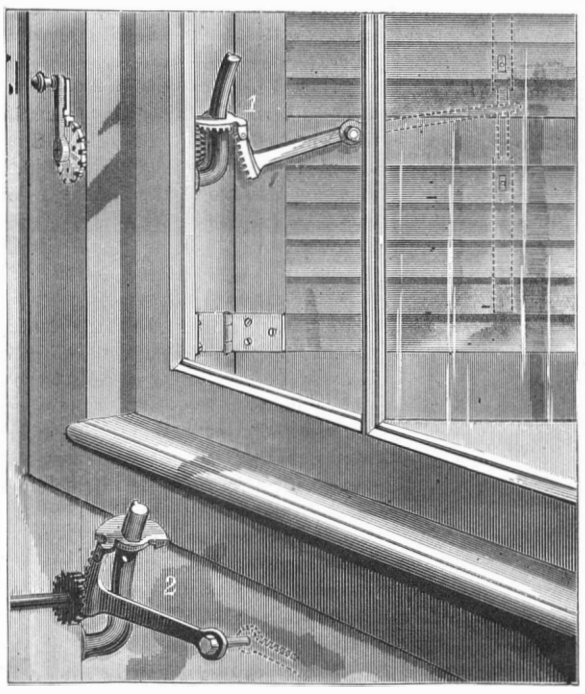
The engraving shows a new window blind operator, recently patented by Mr. Bela G. Merrill, of Geneva Lake, Wis. This apparatus is arranged for opening and closing the window blinds by means of a crank attached to the inside of the window jamb. The slats of the blinds are opened and closed by the same mechanism without altering its adjustment, and by the same crank used to open and close the blinds.

A shaft extends through the window jamb from the inside to the outside, and is provided with a tootbed stop disk, which is engaged by a latch inside of the jamb, to stop the shaft in any desired position. The outer end of the shaft is provided with a spur pinion and a bevel pinion, which are cast together in one piece.

A curved pintle, attached to the exterior of the window jamb by a bracket, is in the axis of the blind hinge, and supports a segment of a toothed wheel, so that it revolves on it just below the lower end of the feather which extends along its side. This wheel has a slot in it which allows it to rise on the curved portion of the pintle when the notch coincides with the feather.

The segmental toothed wheel on the pintle has a toothed arc depending from a point a little beyond one of the ends of its toothed portion. This toothed arc is formed on the end of a lever pivoted to the middle rail of the blind, with an arm inside the shutter connected with the blind slat opener and closer.

By turning the crank so as to close the blind, and by continuing the motion of the crank afterward, the toothed arc



MERRILL'S WINDOW BLIND OPERATOR.

will be raised, lifting the segmental wheel out of gear with the bevel pinion, allowing the shaft to be turned so as to open and close the blind slats. By turning the crank in the reverse direction the toothed arc will be thrown down out of gear and the segmental wheel will descend into gear, with the pinion again ready for opening the blind.

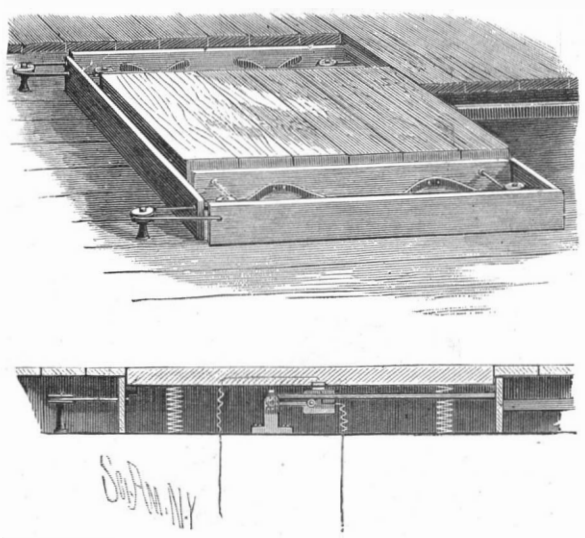
With this device the window blind can be opened and closed without opening the window, and it may be locked securely in any desired position, and by an ingenious connection between the upper and lower slat rods, the upper portion of the slats may be opened while the lower slats are closed.

A FIFTY GALLON BOTTLE.—A bottle of fifty gallons capacity, the largest ever blown in this country, was lately made at Millville, N. J.

NOVEL BURGLAR ALARM.

The annexed engraving represents a burglar alarm platform to be placed in front of the vault or safe to be protected, so that an alarm may be given when they are approached. The device is so constructed that when the platform is stepped upon an electric circuit is operated, which gives an alarm at the distant point. In the engraving the apparatus is shown partly in section. It will be placed in front of the safe or vault on a level with the floor, of which it really forms a part. It covers sufficient space so that a person cannot come within a certain distance of the safe without stepping upon it and giving the alarm.

The platform is supported on spiral springs, and during the day, or when the safe or vault is in ordinary use, movable side and end bars will be moved inward by cords running over pulleys and connected with a sliding frame which



MATNEY'S BURGLAR ALARM PLATFORM.

is moved by a rod extending to some convenient point near the platform. These bars are provided with pins which support the platform, so that it is not depressed when stepped upon. When the safe or vault is to be protected the bars will be released, when they will be moved outward by the springs, leaving the platform free to move. The operation of releasing the bars also releases the lower electrical contact and breaks the circuit, so that when the platform is depressed it completes the electric circuit and gives an alarm at a distant point. Should the rod used to place the platform in its inoperative position be moved the electric contact is made and the alarm is given, so that it is difficult or impossible to tamper with the device or get it in an inoperative condition.

This ingenious device has been patented recently by Mr. W. D. Matney, of Harvel, Ill., who should be addressed for further particulars.

Gradients for Sewers.

In many towns, especially those situated on the sea coast or estuaries, it is very difficult to obtain a fall sufficient to prevent deposit in the sewers. Those who have to carry out new drainage works, says the *Building News*, ought to know the experience of engineers on this question, and we, therefore, give a few figures that may be useful. Mr. B. Latham, C.E., in his "Sanitary Engineering," says "that, in order to prevent deposit in small sewers or drains, such as those of 6 in. and 9 in. diameter, a velocity of not less than 3 feet per second should be produced. Sewers from 12 to 24 inches diameter should have a velocity of not less than 2½ feet per second, and in sewers of larger dimensions, in no case should the velocity be less than 2 feet per second." Of course, small sewers require a greater fall than large ones. For 4 inch pipes a greater velocity than 3 feet per second may be given. Mr. Bailey-Denton, in his work, states that for ordinary sewage a mean velocity of 150 feet per minute is required, and this opinion agrees with that of Mr. John Phillips, of the Westminster district. Mr. Hawksley and Sir Joseph Bazalgette both think a velocity of two miles per hour, or 176 feet per minute, necessary when running three-quarters full. When running half full, 165 feet is sufficient, and 146 feet when one-third full, according to the latter authority.

The following may be observed as safe falls for circular drains running half full: For 4 inch pipes, a grade of 1 in 36; 6 inch pipes, a grade of 1 in 60; 9 inch, 1 in 90; 12 inch, 1 in 200; 15 inch, 1 in 250; 18 inch, 1 in 300; 36 inch, 1 in 600; 48 inch, 1 in 800. Mr. Wickstead's table of inclinations gives rather flatter gradients. These gradients cannot be obtained in some towns without deep cuttings, which would make the outfall preposterously deep. Pumping has to be resorted to in some towns, where these gradients are impracticable, unless some other means of projecting the sewage by pneumatic action, as in Shone's system, be adopted. The volume of sewage must be sufficient also besides the gradient to insure self-cleansing.

CHICAGO is the greatest lumber market in the world. The single item of sawed lumber received there in 1881 would lay an inch flooring fourteen feet wide round the earth at the equator. The amount of lumber manufactured in the three States of Michigan, Wisconsin, and Minnesota during 1881 would lay such a floor fifty feet wide.

New Bleaching Process.

The *Textile Manufacturer* describes a new process for bleaching manufactured cottons, especially cotton on bobbins. The cotton is placed in a closed reservoir lined with lead. The reservoir is about 10 feet long, 7 feet broad, and 5 feet deep, and can hold 300 pounds of cotton. A rubber tube connects the reservoir with an apparatus in which about three cubic yards of chloroform vapor are set free by using sulphuric acid on a mixture consisting of one part quicklime, one part chloride of lime, one part spirits of wine or acetic acid, and four parts water. The vapor is conducted into the reservoir, where for about two hours a pressure of two atmospheres is put on the cotton, after which the bleaching is accomplished. Afterward a mixture of hydrogen, carbonic acid, and sulphuric ether, produced in a Wolff bottle, is passed over the cotton, and in fifteen minutes all smell has left the bobbins.

A Lily with 145 Blossoms.

An uncommonly fine specimen of the Easter lily of Bermuda was lately brought to this city from Jamaica. It bears 145 blossoms, nearly all of which are in full bloom. The stalk, about one inch in diameter, is thickly infoliated with long leaves for its entire length, about three feet. Nestled in a cluster of these dark green wrappings at the summit of the stalk are closely grouped the stems of its numerous funnel-shaped blossoms, which fall over it in a cloud of white and yellow perianths, forming a hemispherical mass of flowers of about one foot radius. No specimen, it is said, has ever been seen in this latitude with over 100 blossoms. A specimen with 90 blossoms took the first prize at the Horticultural Exhibition in this city, May 3.

A Notable Steel Chain.

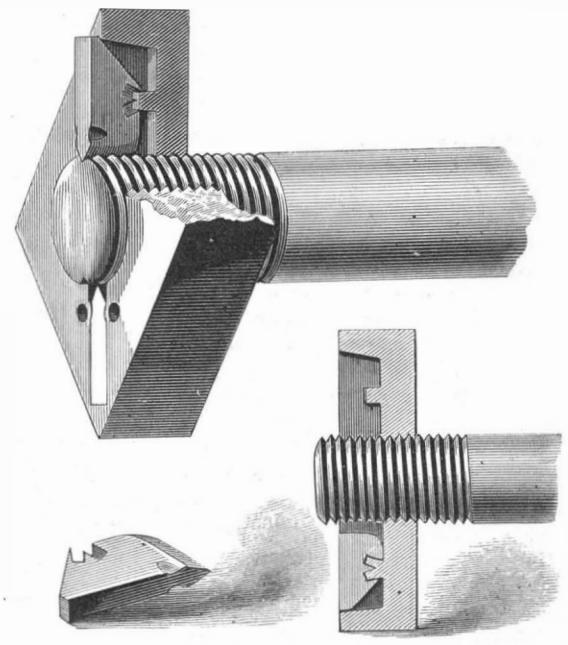
There has lately been made at Hull, England, a chain of Siemens steel, 180 yards long, containing more than 3,200 links, held together by about 850 steel pins. It is intended for lifting purposes, has an estimated strength of 60 tons, and is thought to be the largest chain of its kind ever made.

The Corinth Canal.

The ceremony of turning the first sod on the line of the proposed Corinth Canal was performed by the King of Greece, April 5. The canal will connect the Gulf of Corinth with the sea of the Archipelago, and considerably shorten the route from the western parts of the Mediterranean and the Adriatic Sea to Athens and the ports of the Ægean Sea.

NEW NUT LOCK.

The engraving shows a novel nut lock recently patented by Mr. Joseph H. Burrows, of Boise City, Idaho Territory. In this invention the nut is provided with one or more recesses, having in the bottom a transverse ridge. The keys fitting these recesses have their inner ends sharpened and their outer ends beveled. They have on their inner edges



BURROWS' IMPROVED NUT LOCK.

two diverging recesses having a sharp pointed nose or wedge between them, and when the key is forced into one of the recesses of the nut the sharp inner edge cuts into the thread of the bolt, preventing the nut from turning, and the wedge on the inner edge of the key splits the projection in the bottom of the recess in the nut, and forces the parts of this projection into the recesses in the inner edge of the key, thus holding the key securely in the recess with its edge embedded in the threads of the bolt, as shown in figure.

In some cases the inventor still further secures the keys by making indentations by means of a center punch, or otherwise, so as to force the metal of the nut over the top of the key.

This nut lock holds the nut so securely that it cannot jar loose or be turned except after the removal of the key. The device is exceedingly simple and is readily applied.

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LIFE-SAVING APPARATUS AT THE RECENT NAVAL AND SUBMARINE EXHIBITION.

(*Continued from first page.*)

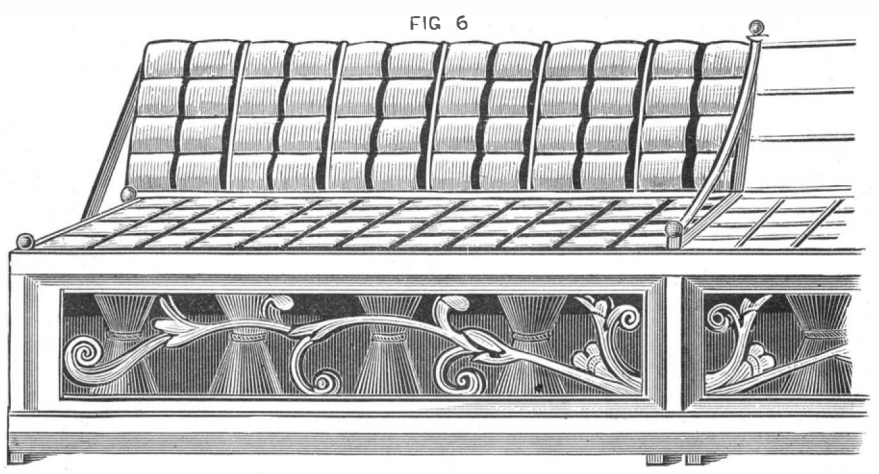
900 passengers. The decks proposed are fore and main and fore and aft saloon decks, and sponson house tops. The design took a first prize at the aquarium. Figs. 2 and 3 show the raft on deck and afloat. This raft took the 100 guinea prize at Islington.

Rose's life-buoy seat, shown in Fig. 3, consists of two thin iron buckets screwed together at the bottom, with tops closed. They may be used as buckets, or a buoy, or to render a hencoop seat buoyant—*vide* Figs. 4, 5, and 6. The cushions of the hencoop seats are life belts. A specimen made for Sir T. Brassey's yacht, the Sunbeam, was shown.

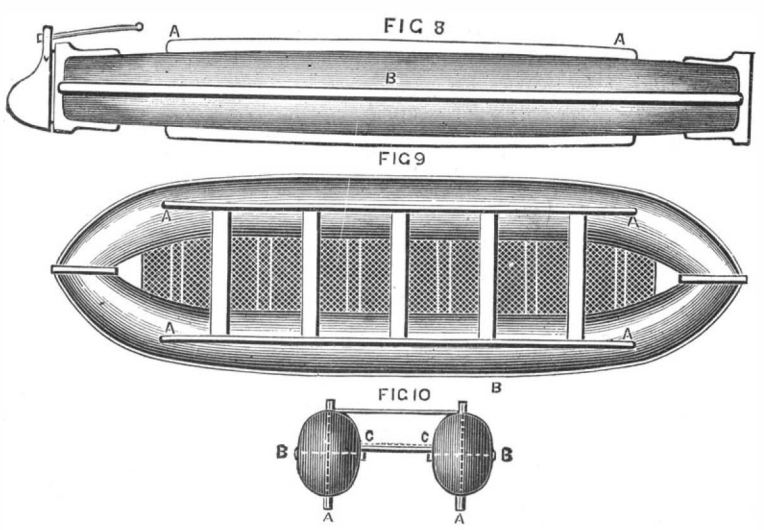
Copeman, of Downham Market, exhibited a raft constructed of seats by means of connecting rods, spars, and grating seats. This was put together by two men in less than two minutes repeatedly at the Exhibition (see Fig. 7). It is a very serviceable, strong, and simple arrangement. The inventor claims that the expense is small—about $25 extra on each seat; that the space occupied is no more than that of ordinary seats; that it is always ready for use, and when in the water cannot be upset. Masts and oars are carried. The strength and simplicity of this will probably commend it. It is to be tried shortly for the Prince of Wales.

The wreck escape, shown in Figs. 8, 9, and 10, is the work of Mr. Hodgson, another practical man eminently qualified to judge as to what may be done in a moment of danger, having earned eight or nine medals for saving life himself, and also so ready to point out anything good in designs of others, that one must respect the honesty of his opinions. Two wreck escapes, one of wood tubes and cells, the other steel, weight 7 to 17 cwt., supporting twenty to seventy-five men; rope bottom reversible; may be used as an ordinary boat, the resistance being brought down to much less than is usual in bottomless boats. It is stated that it has been actually tried and obtained good speed. The form appears to be a very good one for a bottomless boat. It was tried with success before Admiral Mends in 1869. It is, we believe, the first and also the best reversible boat. It is possible for a man under it to open the ropes asunder and creep through the bottom.

Figs. 4 and 5.—ROSE'S LIFE BUOYS.



ROSE'S LIFE SEAT.



HODGSON'S WRECK ESCAPE.

PREPARATION OF ALUMINUM.—Aluminum sulphide is obtained from powdered cryolite; and it is then decomposed by heating to redness with iron turnings. The cryolite is first dissolved in water, which dissolves out the sodium fluoride. The residue, aluminum fluoride, is calcined with calcium sulphide, the results being aluminum sulphide and calcium fluoride.

Inspection of Locomotive Boilers.

The following regulations for the inspection and test of locomotive boilers have been adopted and published by the Massachusetts Railroad Commissioners under the provisions of chapter 73 of the acts of 1882:

1. All boilers for locomotives, before going into service, must be subjected to a hydraulic pressure of 150 pounds per square inch. 2. The water must be heated to near the boiling point. 3. This test must be repeated at least once a year. 4. The superintendent of motive power, master mechanic, or other proper agent of the company will attend in person. He will remain outside, while an assistant will examine the fire box from the inside. 5. A record of all tests will be made, giving dates and anything worthy of mention, and communicated to the board. 6. Special examination of the stay bolts of locomotives in service should be made not less frequently than once in three months. 7. When these examinations are made, all the water must be drawn from the boiler, so that the vibration of the sheet may indicate any unsoundness of the stay bolt when it is struck with the hammer. The board urgently recommends, in addition to these regulations, that the four upper rows of stay bolts shall be drilled from the outside three-fourths of an inch in depth and three-sixteenths of an inch in diameter.

Coal by Wire.

The proposal of Sir Henry Bessemer to bring coal by wire, instead of by rail, is very simple. Although coal is still our great agent in the production of motive power, it must not be forgotten that Sir William Thomson has clearly shown that by the use of dynamo-electric machines, worked by the Falls of Niagara, motive power could be generated to an almost unlimited extent, and that no less than 26,250 horse-power so obtained could be conveyed to a distance of 300 miles by means of a single copper wire of half an inch in diameter, with a loss in transmission of not more than 20 per cent., and hence delivering at the other end of the wire 21,000 horse-power. Sir Henry exclaims, "What a magnificent vista of legitimate mercantile enterprise this simple fact opens up for our own country! Why should we not at once connect London with one of our nearest coal-fields by means of a copper road of one inch in diameter and capable of transmitting 84,000 horse power to London, and thus practically bring up the coal by wire instead of by rail?" He supplies the equivalent in coal of this amount of motive power. Assuming that each horse-power can be generated by the consumption of 3 lb. of coal per hour, and that the engines work six days and a half per week, we should require an annual consumption of coal equal to 1,012,600 tons to produce such a result. Now, all this coal would, in the case assumed, be burned at the pit's mouth at the cost of 6s. per ton for large and 2s. per ton for small coal—that is, at less than one-fourth the cost of coal in London. This would immensely reduce the cost of electric light, and of the motive power now used in London for such a vast variety of purposes, and at the same time save us from the enormous volumes of smoke and foul gases which this million of tons of coal would make if burned in our midst. A 1-inch diameter copper rod would cost about £533 per mile, and, if laid to a colliery 120 miles away, the interest at 5 per cent. on its first cost would be less than 1d. per ton on the coal practically conveyed by it direct into the house of the consumer.—*Iron.*

Furniture Polish.

A. Messer, of Berlin, dissolves 3 kilos of shellac in about 15 to 20 liters of pure spirits (alcohol), and then mixes this with another obtained by dissolving 100 grammes of gun cotton in 100 grammes of high-grade sulphuric ether to which is added 50 grammes camphor and enough 96 per cent. alcohol to completely dissolve the mass. This polish is finally rubbed up with pure linseed oil. To 100 parts of it, 5 parts of a saturated solution of camphor in oil of rosemary are then added. A very dilute solution of benzole in alcohol is used for polishing off.

The Lamson Case.

Among the affidavits bearing on the case of Dr. Lamson received by Mr. A. W. Mills, the prisoner's solicitor, was one by Dr. H. H. Kane, who has charge of a hospital in New York devoted to the treatment of persons habituated to the use of opium and other drugs. He is described as author of the following works on the subject: "The Hypodermic Injection of Morphia; its History, Advantages, and Dangers," New York, 1879; "Drugs that Enslave; a Study of the Opium, Morphine, Chloral, and Hashisch Habits," Philadelphia, 1881; and "Opium Smoking in America and China," New York, 1882. After mentioning that the majority of his patients are and have been physicians or druggists, and dwelling upon the tendency to carelessness in prescribing morphia and other drugs which he had noticed in the case of those who had become accustomed to use such large doses of such drugs themselves, Dr. Kane remarks that, as regards the question of insanity from the habitual use of opium or its alkaloids, more especially morphia, but little definite is known. Insane asylum reports every year record from one to eight or nine cases of insanity attributed to the prolonged use of opiates, and physicians in general practice recognize the use of narcotics as a rare, though well-established, cause of insanity. A person with a hereditary tendency to insanity, or with a mind weakened from any combination of circumstances, or from actual bodily disease, using this drug in large amount for a considerable time, could hardly escape some unsettling of his mental and moral powers. In the majority of instances the insanity thus produced is chiefly marked by weakening of the will power, entire change of the moral tone, loss of business ability, sundering of family ties, and carelessness about the ordinary duties of life. Actual mania, melancholia, and dementia are probably rare, but have undoubtedly occurred from this cause. Some persons inherit or acquire in after life an idiosyncrasy which renders them more susceptible to the physical, mental, and moral ill effects of opium than obtains in the ordinary individual, and a like idiosyncrasy has been known to lead to death from doses previously considered safe. This is especially true with reference to the hypodermic use of morphia. Certain persons can take large doses of opium for years with impunity, while others, of a peculiarly nervous temperament, are injured out of all proportion to the time the drug has been used or the amount taken. In the majority of cases, habitual users stop short of actual insanity as ordinarily classed, although they manifest marked deterioration or total abolition of will power and memory. A tendency to lie with reference to their habit, inattention to family and business, and the manifestation of a very decided change in moral tone may be marked. Dr. Kane would say, in conclusion, that of all forms of the opium habit, that of hypodermic injection as a rule works the most harm in the shortest time.—*London Times.*

The Loess of North America.

The distribution of the loess formation in the Central basin of the United States is summed up as follows by Mr. R. E. Call, in a recent issue of the *American Naturalist:*

It is found in the States of Ohio, Indiana, Michigan, Iowa, Kansas, Nebraska, Illinois, Tennessee, Alabama, Mississippi, Louisiana, Arkansas, Missouri, Kentucky, and in the Indian Territory; but *in every instance* is apparently confined to the higher lands along the larger streams. Its superficial extent is greatest in Nebraska, where, according to Aughey, its area is three-fourths that of the State, or 56,994 square miles. In Iowa its superficial area is estimated by White at about 5,000 square miles, but his calculations included only those sections along the Missouri, inasmuch as he was evidently unacquainted with its existence in Central Iowa, and in the eastern portion of the State. Its area appears to be next greater in Missouri, which is, indeed, but the southern extension of the Iowa and Nebraska deposit. In most of the other States where it occurs its area is comparatively small. It is not found outside of the central basin. Its material is exceedingly fine, very silicious as proven by numerous analyses, ashy color with slight yellowish tinge—normally; and often highly calcareous. In all these repects it agrees entirely with published descriptions of foreign loess. *In situ* it presents a remarkably homogeneous structure, usually appearing in massive walls without, or with but faint lamellation, the latter feature being purely local. So perfect is the homogeneity that very careful examinations of specimens of soil from the Missouri valley and the valleys of the Des Moines and Iowa rivers failed to reveal even slightly marked physical differences.

SOAPSTONE ground fine can be moulded into different shapes by mixing with water-glass, and when dried closely resembles the natural stone.

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The Rabbit Pest in Australia.

The Chief Inspector of Stock of Victoria, Australia, gives in a recent official report the following account of the rabbit pest in that colony:

Rabbits are to be found, less or more, all over the western and northwestern portions of Victoria, and as far up the Murray as the Owens River, but in no great numbers as yet, and from Echuca upward they are principally confined to the banks of the river. In the western districts they are very numerous and destructive, and in the Wimmera, where the country is comparatively scrubby and poor, it may be said they have all but taken possession of the crown lands, and to a large extent also of the alienated land. On one property alone iu the Colac district it is said that between $150,000 and $200,000 have been spent in destroying rabbits, while some owners are paying as much as $10,000 a year to keep them down, many $5,000 a year, and almost every holder of land is year by year put to a considerable expense in protecting his pasture and crops from these pests.

A great many modes of dealing with this evil have been tried in Victoria, viz., fencing the rabbits out, shooting, hunting with dogs, ferreting and netting, snaring and trapping, digging out and blocking up the burrows, and destroying the rabbits with noxious gas and poison. In all these modes, again, the work is at times done by the owner's own men, sometimes by contract, and at other times under the bonus system. When the rabbits are to be fenced out a wire netting, 4 feet broad, with 2½ inch mesh, is put on an ordinary wire fence, the netting to the extent of one foot being bent and put in the ground at an angle to prevent the rabbits from burrowing. They try to do so close at the foot of the fence, but stop when they come upon the netting. The cost of the netting for a fence rabbit-proof of this sort is about $250 a mile; and if it is found that rabbits cross the Murray after our land is cleared, and Victoria continues to be infested, it may be necessary to run a rabbit-proof fence along the river to keep them from again obtaining a footing in this colony. Dogs (terriers, cockers, and other dogs which hunt by scent) and guns are generally used together, though sometimes kangaroo dogs and greyhounds are taken out with the terriers to kill the rabbits they put up. Where the rabbits have made a settlement the most effective, but the most expensive, way is to dig them out, or, where it can be done (in rocky and stony ground) to block up the burrows and starve the rabbits in their holes. Ferreting and netting is also a very successful mode of destroying them; but ferrets are comparatively scarce, they are liable to be lost, and every one cannot manage them. A good many have also been taken in traps and snares, but these appliances are also expensive and comparatively slow.

The exterminator (the machine employed to charge the burrows with noxious gas) is also in some cases an effective mode, but it is expensive, and the machine is cumbersome and unwieldy to take about, while the holes at times in the warrens are of such a sort (as in the case of bilbee and wombat holes, of which the rabbits take possession) as to render the gas inoperative; and in other cases there are fissures in the ground which allow it to escape. A good many different sorts of poison have been laid, and in a great many different vehicles.

(1.) *The Poison.*—The poisons most frequently used have been arsenic and phosphorus, and in a few cases strychnine. Arsenic has been longest used, generally in conjunction with sugar and bran. Phosphorus, again, has been more recently tried, and is now far more generally laid than any other poison.

(2.) *The Vehicle.*—A mixture of crushed wheat and sugar, or bran and sugar, has been found an excellent vehicle, so far as destroying the rabbits is concerned, but the mixture is dangerous for stock, more especially sheep. Whole wheat has been used successfully, with arsenic, and latterly with phosphorus, but does not seem to retain the poison so long as the oats, and is more liable to be eaten by sheep. Oats have within the last few years been employed very successfully and extensively as a vehicle for phosphorus. Carrots have also been tried with good results as a vehicle for arsenic. This is what was to be expected, as all animals are fond of carrots, but the supply is comparatively limited, and in many cases they cannot be laid without endangering the stock; they are poisoned by bruising the outside and strewing it with arsenic. Potatoes have been used successfully as a vehicle for strychnine, and could of course also be used for other poisons, especially arsenic. Turnips, pumpkins, and melons could be used in the same way as carrots; and cabbage leaves, turnip tops, green corn, and sorgham could also be made vehicles by slitting or opening them, where there is room, and laying the poison in slits or openings. But all these, like carrots and potatoes, can only be used where the stock can be removed from the paddock, or where these vehicles can be laid where the stock cannot get them. In cases, however, where the rabbits have been reduced in number, and it is of course of great importance to complete their destruction, sufficient precautions could be taken by laying down hollow logs, digging holes in the ground, fencing off small patches, and in other ways to keep the stock from reaching the poisoned vehicle.

Oil of rhodium has been employed successfully in conjunction with some of these vehicles as an attraction for the rabbits, and, although expensive, might be added where they cannot otherwise be induced to take the poison, or it might be so to make them take it more readily. The reports under this head are very conflicting with regard to effect of poisoned grain. It is allowed that the poisoned grain is not nearly so successful when the grass is green and plentiful as it is when dry and scarce. It is also generally allowed that while oats and wheat poisoned with phosphorus have at first been successful in destroying the rabbits, it is at the same time the opinion that the rabbits after a time cease to take either the one or the other. I think, however, that these results are only what were to be expected. When the grass is plentiful and green not only will the rabbits be comparatively careless about food such as oats or wheat, but they will not be so likely to see the grain on the ground as they would when the grass is brown and bare. Then, again, all animals are endowed in a greater or less degree with the instinct which leads them to refuse to take what they see is destroying them. The rabbits would at first—and perhaps for a little time in the case of arsenic, and longer in that of phosphorus, which is a slow poison—take the grain; but as soon as those which took it began to die in any number the others would stop eating the grain. It is well known that the same thing happens where poison is laid for native dogs, rats, and other animals.

Although I think the failure of the attempts made in Victoria to destroy the rabbits with poison is largely due to not changing the vehicle in which the poison was laid, the main cause of the failure there has, in my opinion, been the want of simultaneous action on the part of the owners whose land was infested with rabbits. The law in Victoria is only applicable to a portion of the lands of the colony—that alienated by the crown; and even in the case of land to which the law does apply it has very seldom been enforced, for it has provided no penalty for neglecting to destroy. There the defaulting owner can only be compelled to do so by the shire councils—who have the carrying out of the act—putting men on the defaulter's holding to destroy the rabbits, and, like our own boards of directors, these councils dislike to exercise this power, and have seldom or never done so. The result has been, that while some owners did all they could to clear their land, others did nothing. The rabbits are, therefore, increasing in some districts; as numerous as ever in others; and, although a great many have been destroyed, their spread has not been really checked, for they are every other month making their appearance in fresh districts. Under these circumstances, it is not surprising that in Victoria owners speak hopelessly of being able, except at an expense which would be most oppressive, to do more than keep the rabbits down; but there is little doubt that the result there would have been altogether different had owners been compelled, as they can be in this colony—and as I trust they will be—to carry out the work of extermination promptly and simultaneously on all the holdings.

Chlorate of Potash Explosions.

Potassium chlorate, generally known as chlorate of potash ($2KClO_3$) is composed, as to its distinctive constituents (*i. e.*, apart from its oxygen), of the non-metallic gaseous element, chlorine, and the soft metal, potassium, which is lighter than water, and melts at about the temperature of 145° F. In other words, chlorate of potash is an association of chloric acid (ClO_3) with two atoms of potassium. We believe that the acid has never been obtained in its anhydrous state. As combined with water it is a thick liquid, which sets on fire dry organic substances with which it comes in contact. The chloride of potash, being free of oxygen, has not the ignitive characteristics of the chlorate. Chlorine is a feeble supporter of combustion, but its affinity for hydrogen gives to it certain striking combustive relations in specific proportional combination, largely affected, however, by conditions of temperature, light, and exciting mechanical force. The two elements will not combine spontaneously in the dark—light, according to its degree, causes somewhat gradual combination, producing the suffocative hydrochloric acid (so to speak, an imperfect combustion); but in the direct rays of the sun the instantaneous union makes an explosive combustion. Potassium combines with oxygen with great avidity—hence result the violent reactions shown in the common experiment of throwing some potassium upon water; hydrogen is set free, and burns with the potassium; ultimately a fused globule of caustic potash (hydrate of potassium) remains, which unites with the water below with a sharp explosion.

Hydrogen will burn in an atmosphere of chlorine, where carbon will not. With heat or friction chlorate of potash united with sulphur, charcoal, etc., undergoes dissociation of elements. In heating the chlorate of potash alone, first oxidation proceeds to the perchlorate stage, then complete deoxidation follows, and a chloride of potash remains.

We make these remarks as introductory to an account of an explosion which we take from the Australasian supplement to the *Chemist and Druggist* (London), and will add that in December last we made reference also to the subject of the danger arising from neglect of precaution in handling chlorate of potash.

"A shocking occurrence took place at Wellington, N. Z., on December 21 last, by which a lady was literally blown to pieces and a building partially wrecked. The facts are as follows: At the shop of Mr. Barraud, chemist, London Quay, some blue fire was in course of preparation for use at the theater. On testing a small portion of the mixture it was found dangerously explosive, too much chlorate of potash having been inadvertently used in the composition. Accordingly, Barraud's assistant, named Anthony, took it out in the back yard, and began to destroy it by slow combustion. He had occasion to leave for an instant, and before he could return his wife happened to go into the yard, and seeing chemicals on fire, at once threw a bucket of water on the burning mass. A terrific explosion immediately took place, which shook the whole city, and was heard at a distance of some miles. Mrs. Anthony received the full force of the shock, and was frightfully mutilated. Both arms were torn off, also one leg, the lower jaw, and the scalp. Wonderful to relate, she lingered for some time. All the windows in the vicinity were smashed, and other damage done. The stone mortar in which the composition had been mixed was hurled many feet into the air, and thrown clear over the tops of the houses into the next street. Fortunately nobody else was injured. This dreadful occurrence created a profound sensation in this city."

Some points are worthy of special attention in connection with this event. In the *blue* pyrotechnic compound there was possibly some sulphate; but the question to consider is, whether explosion was dominantly due to dissociation of the water or dissociation of the chlorate. We note:

1. Another instance is given that a compound dangerously explosive can burn by moderate combustion without explosion.

2. There is every probability that the explosion was occasioned by hydrogen liberated by the instantaneous dissociation of a portion of the water. It will be inferred that such effect was more likely to have been produced from a spray of water than from a large body of water.

3. It is possible that the sudden shock of a comparatively large body of water thrown upon the contents of a small mortar aided to increase the force of the explosion. In other words, the molecular constituents of a salt being, as it were, in a state of high tension, or vibration, and almost ready to explode, may be driven to explosion simply by the shock of a liquid thrown upon them. But the violent dissociation of the elements of water thrown upon an ignited mass would itself be a still greater shock.

In Philadelphia, April 13, a drug clerk compounding a gargle, pulverized separately in the same mortar one ounce of chlorate of potash and one ounce of tannic acid—the latter an organic acid. In the trituration of the two together, with sufficiency of friction, an explosion could be taken for granted, but an explosion followed by simply pouring the powdered tannin upon the powdered potassium compound. The heating of the mortar in rapid pulverization suggests itself as the cause of the accident, and possibly there may have been contact with some dampness.

Some time previous to this, some of the salt had fallen from a full drawer upon the guides supporting a drawer of ferrocyanide of potassium immediately below it, in an Arch street drug store; in pulling out the lower drawer, sufficient friction was caused to result in an explosion, blowing out the drawer violently, and causing considerable damage.

As belonging to the same category of phenomena, we note the "discovery" in San Francisco of a violent explosive, which is made by grinding together *one* part of trinitrophenol (one of the anilines), *one* part of tar, and afterward cautiously adding *five* parts of chlorate of potash.—*Amer. Ex. and Review.*

Improvement in Refining and Crystallizing Starch Sugar.

The sugar made from starch, to which it has been proposed to give the collective name of *amylose*, has hitherto been sold either in solid masses or granulated by scraping in finer grains ready for mixing with cane sugar. F. Soxhlet, of Munich, takes the ordinary starch sugar of commerce and mixes with it 70 or 80 per cent of alcohol of 80° Tralles, or pure wood naphtha (methyl alcohol). Pulverized starch sugar is then added to this sirupy mixture and the whole left to solidify at a temperature *above* 30° C. (86° Fah.), with frequent stirring. The sirup obtained in making starch sugar can also be treated in this way. The mass of crystals thus obtained is pressed and put in a centrifugal machine. The alcohol is recovered by distillation.

For making solid transparent starch sugar (dextrose hydrate, $C_6H_{12}O_6,H_2O$) the starch sugar solution is concentrated in a vacuum to 46° B. (taken at 90° C.), and put in moulds to crystallize at a temperature between 35° and 50° (95° to 122° Fah.). At lower temperatures the well-known warty crystals form.

This method depends, it will be observed, upon the removal of uncrystallizable and unfermentable substances from the sugar by means of ethylic or methylic alcohol, in which grape sugar is itself but slightly soluble.

Prize for Comets and Meteors.

So much extra research, resulting in valuable discoveries, was occasioned by reason of the prizes for astronomical discoveries of last year, that Mr. H. H. Warner, of Rochester, N. Y., has concluded to continue the comet prizes during 1882, together with an additional prize for the discovery of meteors.

Prize first is two hundred dollars in gold, for each discovery of a new comet, made in the United States, Canada, Great Britain, or Ireland.

Prize second, two hundred dollars, for any meteoric stone found in any of the above countries during 1882, that contains fossil remains of animal or vegetable life, thus proving the inhabitability of other planets.

Prize third, fifty dollars, for a specimen of not less than two ounces, of any meteoric stone (whether it contain organic remains or not), seen to fall in the United States during 1882

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SIMPLE SOUND RECORDER.

BY GEO. M. HOPKINS.

The complex nature of sonorous vibrations is beautifully exhibited by the records made by the phonautograph; but the instrument is so bulky, so expensive, and so inconvenient to use that few students are able to avail themselves of actual experiments in this direction.

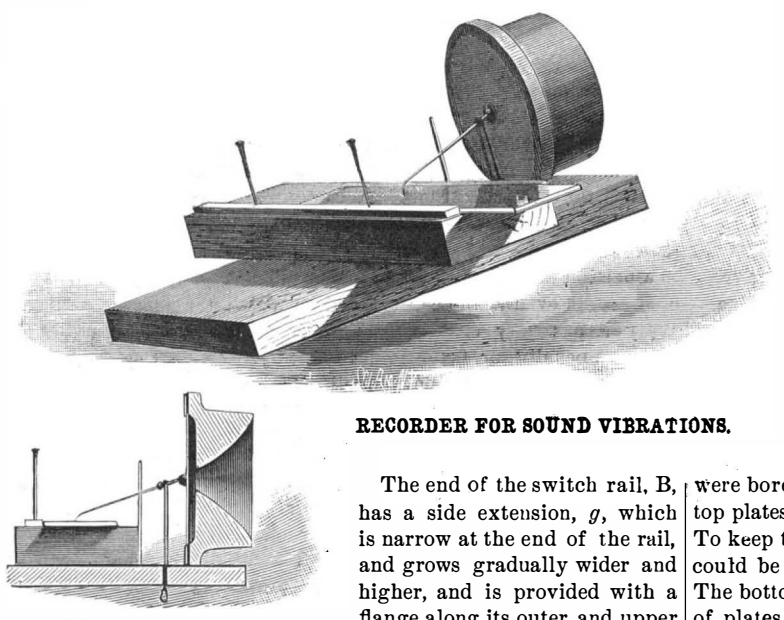
The annexed engraving shows an exceedingly simple device, by means of which sounds may be autographically recorded fully as satisfactorily as with the phonautograph. The main difficulty with this sort of apparatus seems to have been the propelling of the smoked plate at a uniform rate of speed under the stylus. In the instrument illustrated this is accomplished by simply inclining the support of the plate and allowing the plate to slide off quickly by its own gravity.

This apparatus consists of a wooden mouthpiece like that of a telephone, with a parchment diaphragm glued to its back, and provided with a tracing point, which is slightly inclined downward toward the guide for the plate.

This tracing point is a common sewing needle, having its pointed end bent downward. It is cemented at the eye end to the center of a diaphragm by a drop of sealing wax. The mouthpiece is attached to a base supporting the crosspiece upon which the smoked plate is placed.

A thin strip of wood fastened by two common pins—one at each end—serves as a guide for the smoked plate.

To prevent the needle from being deflected laterally by the moving glass a long needle is driven down into the baseboard in contact with the tracing needle; and to give the needle point sufficient pressure to keep it in contact with the smoked plate a very small rubber band is slipped over it and drawn down through a small hole in the baseboard, as shown in Fig. 2, until the necessary tension is secured.



RECORDER FOR SOUND VIBRATIONS.

The best plates for the purpose of making the tracings are the microscope slide glasses with ground edges. They may be readily smoked over a gas jet turned down quite small, or over a candle or kerosene lamp. The flame in any case should be small and the film of smoke fine and very thin.

The smoked plate is placed on the support and against the guide and under the needle, and the instrument is inclined until the plate rests against the guide. Now the mouth is placed near the mouthpiece, and a vowel is uttered, while the instrument is inclined sidewise at a sufficient angle to permit the glass to slide off quickly. Of course the glass should fall only a very short distance, and it is well to provide a soft surface for it to alight on.

If all this is done with the slightest regard for precision a beautiful tracing will be secured, which will show the composite nature of each sound wave. It is surprising how perfectly regular and uniform the entire tracing will be, considering the comparatively crude means employed in producing it.

The beginning of the sinuous line will be somewhat imperfect owing to the slow initial movement of the plate in its descent, but the greater portion will be found perfect.

After having made one line, the pins holding the guide are moved forward, placing the guide in a new position, when the operation of tracing may be repeated with another vowel. Monosyllables and short words may be recorded. If the plate is made long enough it will, of course, receive an entire sentence.

These tracings may be covered with a second microscopic glass plate to protect them, or they may be mounted as a microscopic object for a low power by putting a thin cover over them in the usual way. Used as a lantern slide they give fine results.

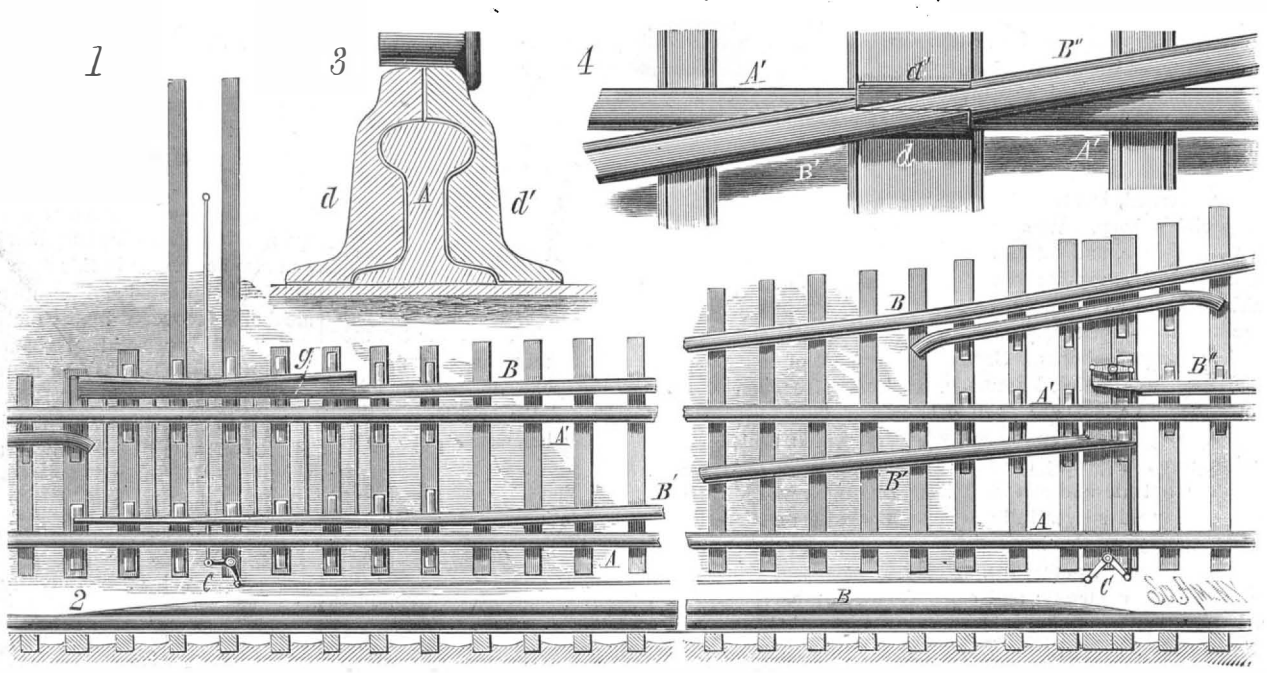
IMPROVED RAILROAD SWITCH.

The engraving shows an improved railroad switch recently patented by Mr. John H. Hortman, of Hopewell, Mercer Co., N. J. The principal novelty in this invention consists in making the switch rails high enough at the points where they take the wheels from the main track to elevate the cars, so that the flanges of the car wheels will be carried over the main rails.

Fig. 1 in the engraving is a plan view of the main track and switch, showing the switch open; Fig. 2 is a side elevation of the main track and switch; Fig. 3 is a transverse section of the main track rail and the switch rails at the junction of the latter; and Fig. 4 is a plan view, showing the inside switch rails closed and overlapping the main track rail.

The switch rails, B B′ B″, are higher at their junction with the main track rails, A A′, than the general level of the track, and the ends, *d d′*, of the switch rails are tapered, and are inclined from the extreme ends upward to the point of meeting, where they are high enough above the main track rail to carry the flange of the car wheel over the main rail. They are cut away below (as shown in Fig. 3) to receive the main rail as they are closed together to form a continuous switch rail. This rail is lapped on a joint that is parallel with the median line of the main rail, so that the wheels may be carried upward and over the main rail without shock or jar.

Both ends of the switch rails are moved simultaneously by means of a switch lever and rods and the bell crank levers, C, and a straight lever connected with the tapered end of the rail, B″.



HORTMAN'S RAILROAD SWITCH.

The end of the switch rail, B, has a side extension, *g*, which is narrow at the end of the rail, and grows gradually wider and higher, and is provided with a flange along its outer and upper edge, which serves as a guide to the car wheel, and pushes the wheel over, while it is raised up, so that its flange passes inside the main track rail before the wheel leaves the extension on the end of the rail.

This invention is intended to avoid all of that class of accidents due to misplaced switch rails by always leaving the main track entire.

Further information in regard to this invention may be obtained by addressing the inventor as above.

The Queen of Bedders.

This rose, which belongs to the Bourbon class, is of a rich, glowing crimson color, very double, and blooms from early summer until frost. Although not a very strong grower, it will amply repay this defect by the enormous quantity of flowers that it produces, which contrast so well with its bright foliage. A bed of these roses, 20 x 50 feet, has been known to have over 20,000 flowers and buds on at one time, a statement which, considering its reliable source, would alone recommend this variety to any one wanting a good plant for that purpose. Now is a good time to plant roses, and the above variety can be had at a reasonable price from any of the firms advertising roses in this paper.

Those who intend planting roses, and wish to have success, should go to the trouble (if the soil is not naturally good) of digging their ground at least 18 inches deep, filling the bottom with a layer of manure, and broken stones for drainage, then filling up with *good rich soil*, adding plenty of sand, sifted cinder, ashes, and lime. But to those who do not wish to go to this trouble, it is sufficient to say that roses will grow in almost any kind of soil. Do not forget to peg down any kind that is of too rampant a growth; they will do better for it.—*Farm and Garden.*

The Hudson River Tunnel.

Work is progressing rapidly and favorably on the New Jersey side of the tunnel. The imperfection in the arch of one section of the brickwork near the second air lock has been repaired. This was effected by removing one plate at a time, excavating the silt until the plate could be readjusted at the proper grade, and then carrying over the brickwork. It was only necessary, says *Engineering News*, to remove the arch from the spring lines, as the remaining portion was perfect. But a few hours were required to bring the section—10 feet—up to grade, when the alignment was as perfect as could be desired. The heading of the north tunnel is now about 950 feet from the shaft.

The caisson at the New York end we described and illustrated in our issue of December 24 last. This caisson was sunk in sand, which followed the water into the chamber upon the least reduction of the air pressure, and which presented a seemingly insurmountable barrier to all future progress; yet the main difficulties have been overcome most creditably, and the north tunnel is now on its way across the river.

Two or three days since we visited this portion of the work, and after donning the regimental raiment, entered the air lock and descended the iron shaft into the caisson. The masonry of the two tunnels has been completed up to the arch of the roof. In the caisson at the New Jersey end, it will be remembered that the tunnels were united in one large chamber; but, in this case, the tunnels have been separated by a common central wall.

When everything was in readiness to cut through the river side of the caisson, auger holes were bored through and the woodwork chipped out and the top plates inserted, braces holding them securely in position. To keep the exposed portion from flaking, before the plates could be adjusted, wooden sheathing was held against it. The bottom of the tunnel was started as soon as the ring of plates was finished, and then the sides and arch were built. At a distance of 12 feet from the side of the caisson a bulkhead of iron plates was built and braced by struts resting against the caisson. This plan was due to the ingenuity of Chas. W. Clift, the master machinist of the entire works. This bulkhead will be moved forward, section by section, until the work is free from sand, and will be braced from the end of the completed masonry. In order to prevent the escape of air, the joints and exposed portions of the heading are covered with a layer of silt brought from the other side. This renders the work practically air-tight, and has proved an economical and effective substitute for other materials calculated to accomplish the same results.

The masonry is 2 feet thick, and is lined with compressed asphalt and limestone bricks 4 x 5 x 12 inches. The seams are of pure Saylor's American Portland cement. This method of construction renders the work both air and water tight, and if the brickwork be of ample strength, the fact that the bond between cement and asphalt is not perfect, and the fact that brick made of asphalt and limestone, although brittle when struck a sudden blow, will yield slowly to compression, are problems which in this case become of minor importance.

The exposed parts of the caisson have been covered with a layer of cement as a preventive against fire and decay.

The bottom of the tunnel is 56 feet below mean low tide, the air pressure 17 pounds, and the temperature 84° Fahr.

Oiled Floors.

The dangers attending oiled floors and seats in public buildings, appear to have been illustrated in the recent destruction of Walker Hall, one of the Amherst College buildings, whose floors had been oiled only the day before. The danger is not so much in saturating the woodwork, but in the waste used in performing the operation, which careless workmen are liable to leave behind them. The *Springfield Republican*, in speaking of this fire, relates also another instance: that some years ago contractor Johnson, who built the Northampton First Church, and many other similar edifices in the Connecticut Valley, "had an impression" one evening that something was not right about a church he was finishing, the pews of which the workmen had been oiling that day; so he went to the building and unlocked it to find that flames were just breaking out near the entrance of the audience room. When one of the men left work at 6 o'clock he laid the piece of cotton waste which he had been using on the rail of the last pew, and the result was spontaneous combustion in three or four hours.

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SUCCESSFUL MANAGEMENT OF THE INSECTS MOST DESTRUCTIVE TO THE ORANGE.

BY PROF. C. V. RILEY.

The orange interest is assuming proportions in Florida and the Pacific Coast which few, not familiar with the facts, suspect. Yet no crop is more seriously affected with insect enemies, and successful orange culture is generally a question of their successful destruction. By far the worst of these are the scale insects (*Coccidæ*), a family most destructive to various fruit trees in all parts of the country, but especially severe on the orange.

Having recently presented to the National Academy of Sciences, at its annual session, some of the results of the investigations in this line now being made by the Department of Agriculture, I take this means of giving them publicity. The figures accompanying this communication will sufficiently illustrate the life-history and appearance of the particular scale-insect treated of. Fig. 1 shows the development of an allied species injurious to the apple; Fig. 2, the characters of the male, and Fig. 3, those of the female; while Figs. 4 and 5 show the general appearance of two of the orange species. In this connection it is not necessary to enter into the subject of classification, but it will be well to state that the species affecting the orange may be divided into two groups, namely, the naked species (*Lecaninæ*), and the protected species (*Diaspinæ*). The former are by far the least destructive. They seldom increase to an injurious extent, being far more easily affected by parasites, and more amenable to the action of simple insecticides.

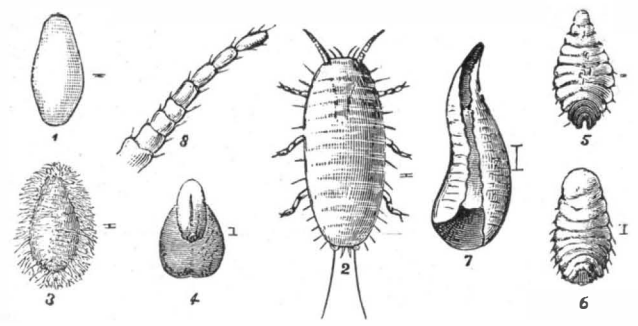

Fig. 1.—MYTILASPIS POMICORTICIS, Riley—1, egg; 2, newly hatched larva; P, its antenna; 3, do., after it is fixed and begins to secrete its covering; 4, scale showing larval and median parts; 5, female extracted from scale soon after losing members; 6, do., full grown; 7, ventral view of full formed female scale—all magnified, the natural size indicated (after Riley).

Of the scale-covered group three species are worthy of particular mention, and, in fact, comprise the only especially destructive species to the plant in Florida. They are: (1), *Mytilaspis gloverii*, Pack, (Fig.4,) which may be distinguished as the "Long scale." It is of a narrow, elongate form, and probably the most destructive and common.

(2.) *M. citricola*, Pack. (Fig. 5), which may be known as the "Purple scale," on account of its color. It is much like the former in form and in its work, and seems to prefer those trees which have very large oil cells, like the Tangierine, etc.

(3.) *Parlatoria pergandii*, Comstock—a small and more nearly circular scale, which so closely resembles the bark in color and general appearance that it is frequently overlooked by orange growers. From its resemblance to a lot of chaff it may be called the "Chaff scale." It affects the trunk and the larger limbs, and usually multiplies to such an extent that one scale is literally piled upon another, thus helping the chaff-like appearance. It is almost always associated with the others on the same tree, and while it is perhaps less injurious than they, except on very young trees, it is also the most difficult to exterminate, because of the fact that the ventral portion of the scale is continuous, and thoroughly separates the insect from the bark to which it is attached.

For the benefit of those who are unfamiliar with the characters of this family of insects, it may be, perhaps, well to say that, for practical purposes, their life may be divided into three principal periods: 1st. The period of *migration*, when the minute six-legged young are active, and crawl

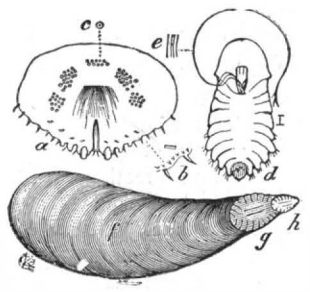

Fig. 3.—MYTILASPIS POMICORTICIS, Riley—showing female scale with its larval (*h*), median (*g*), and anal (*f*) parts; ventral view of female, *d* —the natural sizes in hair line; anal plate, *a*, with its secretors, *c*, and marginal points, *b*; and parts of proboscis, *c* (after Riley).

about rapidly over the tree—a period which lasts but a few hours, or, at the most, one or two days. 2d. The period of *growth*, during which the insect becomes fixed, losing its legs by the first moult, and assuming a more degradational character, and during which the protecting scale is excreted. The females undergo two moults, the cast-off skins assisting in the formation of the scale, while the males, existing parallel to the females up to the second moult, cast their skins a third time and assume an active winged form, vastly unlike that of the fixed, memberless female. This second period varies in duration with the season, and may extend from one to two months. 3d. The period of *incubation*, which includes the laying and hatching of the eggs, and which, like the preceding period, varies according to the season, but which is rarely entirely suspended even in winter in Florida.

Now, it must be plainly seen that the best time to reach and destroy these insects is during the brief migrating period, and, were these periods at all well defined, it would be easy to watch for them and to destroy the insect by various very simple applications to which it is amenable in this unprotected state. But, unfortunately, this migrating period has no distinct and definite limits in time. For while it is short for the individual, it extends over a much longer time for the species. Even after the insects are settled, or up to the first moult, they are readily destroyed by various washes, and during the latter period of growth there are times, especially when the insect is moulting, that the body is partly exposed at the edge of the scale, and therefore when it is more easily reached with such applications. Hence, at almost any season of the year, individuals will be somewhat differently affected by one and the same application, since there is more or less irregularity in the hatching and moulting of the different individuals.

When the scale is once fully formed, however, few insects are more difficult to reach and destroy than these particular coccids; for the upper portion of the waxy scale is impervious not only to rains, but to acid and alkaline solutions, and resist even oils and bisulphide of carbon. The thinner ventral scale is, however, not proof against the more volatile oils and alcoholic solutions. They are least affected when the scales are thus fully formed and crowded with eggs; for experiment has shown that the eggs (and this seems to be a rule with all oviparous animals) have greater vitality and more fully resist the effects of insecticides than the parent insect. Consequently the periods of greatest resistance just precedes the migrating or most vulnerable period. The former or most resisting periods may be said to occur in February, May, August, and during the winter months; while the periods when the young are hatching in greatest numbers are the spring, or the latter part of March; the summer, during June and July; the fall, during September and October; and sometimes a fourth period, during any mild winter weather.

I will now condense the results of experiments carried on in this particular field, under my direction, very much as they have been reported by Mr. H. G. Hubbard, who, since last August, has been stationed at Crescent City, Fla., where he has done admirable work.

From what has been said of the nature and structure of the horny covering which protects the three scales, with which we are chiefly concerned, it will be seen that applications of solid substances are not likely to prove practicable, and that for cheap and effective remedies we must look to penetrating liquids. The cost of alcohol renders its extensive use impracticable. The volatile oils are, as a rule, powerful insecticides, but as they reach the insect from beneath, by penetrating the bark of the tree, and are all to a greater or less degree injurious to vegetation, their use undiluted can in no case be recommended. Some of the light oils, *e. g.*, naphtha, turpentine, etc., are extremely hazardous remedies, and experiments with them are known to have resulted in the destruction of the orange trees upon which they were applied. Experience has shown that of the different applications other than that to which I shall presently direct attention, and which transcends all others in value, the three following have proved most useful, as I have been assured by one of the most extensive orange growers, viz., the Rev. John F. Young, Episcopal Bishop of Florida.

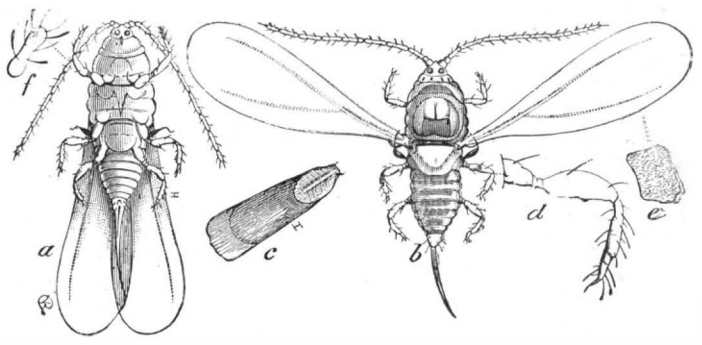

Fig. 2.—MYTILASPIS POMICORTICIS, Riley—*a*, male, ventral view, with wings closed; *b*, do., dorsal view, with wings expanded; *c*, scale, enlarged, the hair lines showing natural size; *d*, leg; *e*, portion of wing; *f*, antennal joint—greatly enlarged (after Riley).

1. One pound of whale oil soap to six pails of water, and a piece of copperas as large as a hen's egg. Dissolve at boiling heat, mix thoroughly, and apply cold.

2. Twenty pounds of quick (lump) lime and two ounces of sulphur; slake the lime in a kerosene barrel, and just before it is entirely slaked put in the sulphur. Stir thoroughly, and use cold.

3. Sixteen pounds of whale oil soap, four quarts of paraffine oil, four gallons of water. Put into an iron kettle, bring to a boiling point, stirring well. Of this solution use in proportion of one quart to four quarts of water.

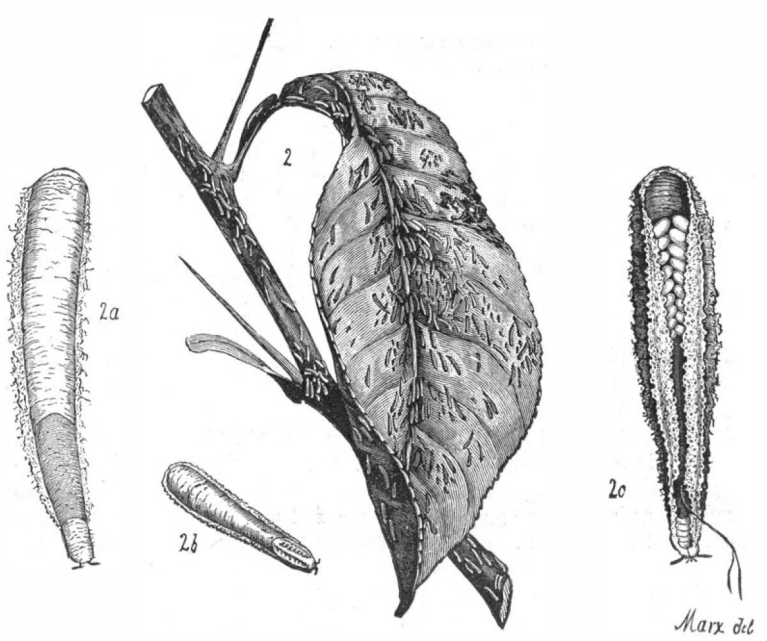

Fig. 4.—MYTILASPIS GLOVERII, Pack.—2, scales on orange, natural size; 2 *a*, scale of female, dorsal view, enlarged; 2 *b*, scale of male, enlarged; 2 *c*, scale of female, with ventral scale and eggs, enlarged (from Comstock).

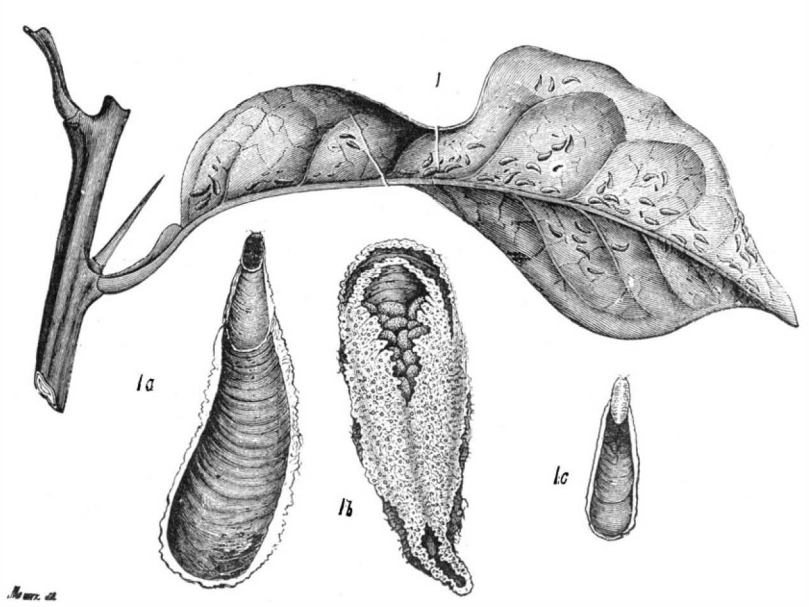

Fig. 5.—MYTILASPIS CITRICOLA, Pack.—1, scales on orange, natural size; 1 *a*, scale of female, dorsal view, enlarged; 1 *b*, scale of female, with ventral scale and eggs, enlarged; 1 *c*, scale of male, enlarged (from Comstock).

KEROSENE.—The value of this substance as an insecticide has long been known. Of all the light oils which I have tried, or of which I have any knowledge, it is the least injurious to plants of the citrus family. Refined kerosene, separated from the deadly naphtha oils, has frequently been used undiluted without injury. Crude petroleum will destroy the bark, and even the refined oil, if applied in the hot sunshine, completely defoliates the tree. Applied in the shade, at sun set, or in cloudy weather, I have never known any serious

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injury to result from its moderate use. The tree invariably loses the old and devitalized leaves, but young and vigorous growths, especially tender sprouts and budding leaves, are entirely unharmed by it. Nevertheless, so many cases of loss are reported that its use undiluted must be considered dangerous. In very fine spray, and with proper precautions, pure kerosene can probably be used with impunity, but all attempts to apply it in small quantities, with other liquids, by dashing them together, should be discouraged as dangerous, or at best unsatisfactory, since it is impossible in this way to insure an even distribution of the oil to all parts of the plant.

There is, however, a safe and ready method of diluting kerosene and similar oils, and of rendering them miscible with water. This method was first indicated by me in speaking of the cotton worm in the SCIENTIFIC AMERICAN for October 16, 1880, as follows:

"Nothing is more deadly to the insect in all stages than kerosene or oils of any kind, and they are the only substances with which we may hope to destroy the eggs. In this connection the difficulty of diluting them, from the fact that they do not mix well with water, has been solved by first combining them with either fresh or spoiled milk to form an emulsion, which is easily effected; while this in turn, like milk alone, may be diluted to any extent, so that particles of oil will be held homogeneously in suspension. Thus the question of applying oils in any desired dilution is settled, and something practicable from them may be looked for."

Whatever want of success in the attempts that have hitherto been made to emulsify kerosene has been solely due to the failure to appreciate the true method of combination and the consequent use of an imperfect and unstable emulsion.

Based upon the above quoted passage, attempts were made by Prof. J. H. Comstock, during his connection with the Department of Agriculture, to produce this emulsion, and in his last year's report to the Department, he makes it manifest that he fails to appreciate the importance of the discovery, or to successfully make the combination; for he produced nothing but such mixtures as required constant stirring in order to keep the oil suspended in water. Mr. Hubbard has had no difficulty whatever in making a perfectly stable emulsion, and the secret of so doing consists in the proper amount of churning; for the whole process may be comparable to butter churning, with the exception that the oil and milk, in any desired proportion, must be much more violently churned for a period varying, with the temperature, from fifteen to forty-five minutes. The emulsion, such as Prof. Comstock obtained, is in a few minutes produced in the form of a creamy fluid, in which finely divided particles of oil can plainly be detected.

In Mr. Hubbard's words: "This is as far as the process can be carried on by stirring, or by dashing in an ordinary churn. The product at this point will not bear diluting with water, and separates or rises at once to the surface. On continued churning the liquid finally curdles and suddenly thickens to form a white and glistening butter, perfectly homogeneous in texture, and stable. The whole amount of both ingredients solidifies together, and there is no whey or other residue. If, however, the quantity of the mixture is greater than can be kept in constant agitation, a portion of the oil is apt to separate at the moment of emulsification, and will require the addition of a few ounces of milk and further churning for its reduction. This kerosene butter mixes readily with water, care being taken to thin it first with a small quantity of the liquid. The time required to "bring the butter" varies with the temperature. At 60° F., half to three-quarters of an hour; at 75°, fifteen minutes; and the process may be still further facilitated by heating the milk up to, but not past, the boiling point. Either fresh or sour milk may be used, and the latter is even preferable. The presence of kerosene does not prevent or hinder the fermentation of the milk; on standing a day or two the milk curdles, and although there is no separation of the oil, the emulsion thickens and hardens, and requires to be stirred, but not churned, until it regains its former smoothness. Exposure to the air not only permits the evaporation of the oil, but also of the water necessary to hold the oil in emulsion, and the kerosene slowly separates as the emulsion dries up and hardens."

The churning can be done very satisfactorily through an ordinary force pump, such as the well-known aquæpult, it being repeatedly forced from one vessel to another. If sour milk is used there will be no further fermentation, and when kept protected from the open air in a tight vessel, the butter endures for any length of time. The emulsion may be made of any desired strength, as the quantity of milk required to hold the oil does not exceed 10 per cent. Emulsions containing over 80 per cent of oil are, however, not readily held in suspension in water on account of their light specific gravity. Yet those containing less than 30 per cent of oil lose value as insecticides as the oil loses some of its power in becoming emulsified; in other words, the killing power of a diluted emulsion depends not so much on the amount used as on the percentage of the oil contained in it. The results of Mr. Hubbard's experiments, which have been quite extensive, lead him to recommend the following proportion for scale insects, though a smaller proportion of oil will doubtless answer for more tender and unprotected insects: refined kerosene 2 parts, sour milk 1 part—in other words, twice as much kerosene as milk.

Churn until the whole solidifies and forms an ivory white, glistening butter, as thick as ordinary butter at a temperature of 75° F. If the temperature of the air falls below 70°, warm the milk to blood heat before adding the oil.

In applications for scale insects the kerosene butter should be diluted with water from 12 to 16 times, or 1 pint of the butter to 1½ gallons for chaff scales; 1 pint of butter to 2 gallons for long scale. The diluted wash resembles fresh milk, and if allowed to stand, in two or three hours the emulsion rises as a cream to the surface. The butter should, therefore, be diluted only as needed for immediate use, and the mixture should be stirred from time to time. A wash prepared in accordance with the above directions will kill with certainty all the coccids and their eggs under scales with which it can be brought into direct contact. No preparation known will, however, remove the scales themselves from the tree, or in any way reveal to the unassisted eye the condition of the insects within. This can be ascertained only by microscopic examination of detached scales. Time alone, and the condition of the tree itself, will indicate the result of an application.

Kerosene, it is true, loosens the scales from the bark, so that for a time they are readily brushed off, but they afterward become more firmly adherent, and are very gradually removed by the action of the weather. Upon trees thickly infested, a large proportion of the scales are so completely covered up by the overlapping of other scales, or the webbing together of leaves by spiders and other insects, that the wash cannot be brought into direct contact with them, and they are only reached, if at all, by the penetrating action of the oil. This takes place gradually, and the number of bark-lice killed increases for some time after an application, reaching the maximum, in the case of kerosene, about the fifth day.

CRUDE OIL OF CREOSOTE dissolved in strong alkalies, or solutions of soap, forms a very effective remedy for scale insect. It may also be emulsified with milk in the same manner as kerosene. The undiluted oil is, however, exceedingly injurious to vegetation, and destroys the bark of orange and other trees. It is in fact a more dangerous substance than kerosene, and requires to be used with great caution. Solutions, emulsions, and soaps containing it should be very carefully mixed in order that no globules of free oil may be allowed to come in contact with the bark of the tree. Its action upon the scale insect is even more powerful than kerosene, but it does not destroy as large a percentage of the eggs. The effect upon the coccids is not immediate, as in the case of other insecticides, and for three or four days after an application very few of these insects die. At the end of a week, however, the bark-lice are found to be affected, and continue to perish in increasing numbers for a week longer. Even after the lapse of three weeks the destructive action of the oil is still appreciable. These facts lead me to suspect that the insects are killed, in part at least, by the poisoning of the sap upon which they feed. The visible effect upon the plant appears to confirm this view. Leaves upon infested trees begin to drop after four or five days, and the defoliation reaches a maximum during the second week. As is the case with kerosene, the effect upon the tree depends upon its condition at the time of application, but creosote is more severe in its action, and there is greater loss of leaves and infested branches. With care, however, an application of creosote may be made sufficiently strong to exterminate the scale without serious injury to the plant, and as new or vigorous growth is very slightly affected, recovery is rapid.

Simple as are the facts here presented in reference to this kerosene emulsion, and involving, perhaps, nothing scientifically novel, yet their practical value and importance are great and far reaching. I have for years been endeavoring to solve the problem of the safe and effective use of kerosene to plants, because of its well known superior insecticide qualities, and now that the problem is solved, the remedy will soon find universal application, not alone for the specific purposes here indicated, but for most of the insect ills that plants in general suffer from.

Cleaning Engravings.

It very often occurs that professional photographers have brought to them engravings to copy, and it generally happens that they are old, discolored, and stained in great patches about the color of gingerbread. Of all colors this is, photographically, most objectionable, and it is nearly impossible to obtain a passable result. If the engraving happen to be a valuable one the photographer, as a rule, is almost afraid to try and clean it, lest he should spoil it, especially with the receipts we find published in various receipt books. Only a short time ago I was looking over some of these books. One advocated chloride of lime, another hydrochloric acid, and agents of a similar nature. We all know the bleaching power of such powerful agents. With regard to the first named, I, for one, always shun it, as when once it gets in to any organic material it is very difficult to eliminate it again, and it is well known that if any of the lime compounds are allowed to remain the whole fabric, in the course of time, rots and drops to pieces.

I know many amateurs who like this kind of practice in copying old engravings, and are not aware that there is a means of cleaning and restoring them without the slightest possible risk; and, moreover, the plan I am about to propose is a very inexpensive one indeed.

Staining not only occurs in old engravings, but in modern ones we very often see parts of a picture stained sometimes through a knot in the back board, or the wood of the same being full of turpentine. All these markings can be removed. My plan is to get a dish or china tray a little larger than the engraving to be operated upon; if smaller there is a great risk of tearing and damaging the engraving. The bleaching agent is no other than Holmes' ozone bleach. The strength I prefer to any other is one part of ozone bleach to ten of water, well shaken up before pouring into the dish. A much stronger solution can be used—in fact, I have used it as strong as one to five of water; but the reason I use the weaker one is that I am of the opinion that the less of the agent we use the less we have to soak out of the paper afterward.

I immerse the engraving in the solution, face upward, avoiding bubbles. The only caution to be observed is that when the engraving is sodden with water it is somewhat rotten; so the less it is handled the better, though I have not the slightest fear in manipulating engravings of the largest size. Sometimes, if the engraving be only slightly stained, half an hour is quite sufficient, but when quite brown I have left them in for as long as four hours. With a stronger solution the time required is much less.

After all the stains are removed, and the paper has regained its pure whiteness, pour the solution out of the dish into a bottle (as this can be used over and over again—that is, several times until it becomes discolored, when it must be discarded), then fill up the dish with water, changing frequently for about two hours, or, better still, place it in running water. When sufficiently washed it can be taken out and blotted off and then hung up to dry, and, when perfectly dry, I find it advisable to iron on the back with a warm flat-iron; but care must be taken not to have it too hot. When finished it will be as white as the first day it came from the press. The plan is very simple, and my advice is, try it.—*Wm. Brooks, British Journal of Photography.*

THE USE OF AMMONIA IN BAKING POWDERS AND ITS IMPORTANCE AS A CULINARY AGENT.

The recent discoveries in science and chemistry are fast revolutionizing our daily domestic economies. Old methods are giving way to the light of modern investigation, and the habits and methods of our fathers and mothers are stepping down and out, to be succeeded by the new ideas, with marvelous rapidity. In no department of science, however, have more rapid strides been made than in its relations to the preparation and preservation of human food. Scientists, having discovered how to traverse space, furnish heat and beat time itself, by the application of natural forces, and to do a hundred other things promotive of the comfort and happiness of human kind, are naturally turning their attention to the development of other agencies and powers that shall add to the years during which man may enjoy the blessings set before him.

Among the recent discoveries in this direction none is more important than the uses to which common ammonia can be properly put as a leavening agent, and which indicate that this familiar salt is hereafter to perform an active part in the preparation of our daily food.

The carbonate of ammonia is an exceedingly volatile substance. Place a small portion of it upon a knife and hold over a flame, and it will almost immediately be entirely developed into gas and pass off into the air. The gas thus formed is a simple composition of nitrogen and hydrogen. No residue is left from the ammonia. This gives it its superiority as a leavening power over soda and cream of tartar when used alone, and has induced its use as a supplement to these articles. A small quantity of ammonia in the dough is effective in producing bread that will be lighter, sweeter, and more wholesome than that risen by any other leavening agent. When it is acted upon by the heat of baking the leavening gas that raises the dough is liberated. In this act it uses itself up, as it were; the ammonia is entirely diffused, leaving no trace or residuum whatever. The light, fluffy, flaky appearance, so desirable in biscuits, etc., and so sought after by professional cooks, is said to be imparted to them only by the use of this agent.

The bakers and baking powder manufacturers producing the finest goods have been quick to avail themselves of this useful discovery, and the handsomest and best bread and cake are now largely risen by the aid of ammonia, combined of course with other leavening material.

Ammonia is one of the best known products of the laboratory. If, as seems to be justly claimed for it, the application of its properties to the purposes of cooking results in giving us lighter and more wholesome bread, biscuit, and cake, it will prove a boon to dyspeptic humanity, and will speedily force itself into general use in the new field to which science has assigned it.

The Sultan of Turkey.

A correspondent of the New York *Herald*, writing from Constantinople, gives a variety of interesting information concerning the political situation and material progress of Turkey, including personal particulars relating to the Sultan. The writer says:

"The United States is the furthest off and can help him (the Sultan) more than any other nation in developing the vast resources of Turkey. The Sultan reads regularly the SCIENTIFIC AMERICAN, which he has translated into Turkish, and General Wallace, our worthy representative in Constantinople, is higher in favor with the Sultan than are any of his European colleagues."

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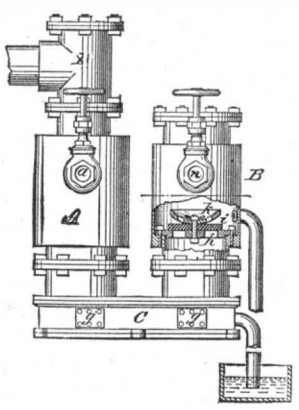
ENGINEERING INVENTIONS.

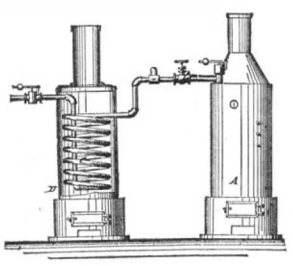
Condenser for Steam Engines.

The device illustrated by the accompanying engraving is an improved condenser for steam engines, in which the vacuum is maintained and is so constructed as to be easy of access to the interior fer cleaning. A is the water chamber, and B the air chamber, both of cylindrical form, and are both secured in an upright position on the hollow base, C. The water cylinder is provided with a pipe for supply of cold water, the pipe having a valve for regulating the supply, and the upper end of the cylinder is formed with a short tube having flanges, to which is bolted a T coupling for connecting the exhaust pipe of the engine. On the upper end of the cylinder is attached a cap. The object of this construction is to save stopping the engine for any length of time when the condenser requires cleaning or repairs. In that case the cap will be removed, a pipe secured in its place, and a plate placed between the T and the tube on top of the cylinder, and the engine then may be run by high pressure. From the end of the base, C, a discharge pipe extends into a tank that contains water to prevent air entering the base, and on the sides of the base are manholes for cleaning it out. In the air chamber, B, is fixed a perforated plate on which is secured a disk valve of flexible material, and above it is a guard that limits the movements of the valve in opening. The cylinder has a discharge pipe for air, and a removable cap is placed on the cylinder to allow access to the valve. When the exhaust steam enters the condenser the shock will raise the valve, and the air will pass out of the pipe, thereby insuring an instantaneous vacuum, the closure of the valve on its seat preventing any return of air This condenser is patented by Mr. Richard E. Williams, of Grass Valley, Nevada county, Cal.



Superheater for Steam.

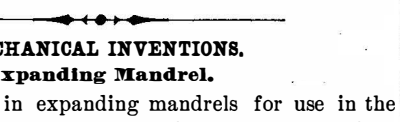
Mr. John Fish, of Summit, Union county, N. J., has patented a new and useful combined steam generator and superheater, that is shown in the accompanying engraving. A is a steam generator, from the steam space of which a pipe leads to a coiled pipe within the furnace, D, forming the superheater, and from the coiled pipe a pipe leads to the place where the steam is to be used. The generator is provided with a safety valve placed in the ordinary manner, and the pipe leading from the generator has a stop valve for preventing the escape of steam from the generator when desired. This pipe is also provided with a check valve opening toward the superheater. The discharge pipe of the superheater has a throttle valve so that the superheated steam may be detained in the heater until raised to the desired temperature, and between the throttle valve and the heater is a safety valve to prevent the pressure of the steam in the heater from rising to a dangerous point. When thus constructed and the throttle valve is closed, the steam can be superheated until its pressure reaches the point at which the safety valve is set, and drawn off when desired through the throttle valve, and the check valve prevents any back pressure on the generator from the superheated steam, so that a generator of ordinary strength can be used.



MECHANICAL INVENTIONS.

Expanding Mandrel.

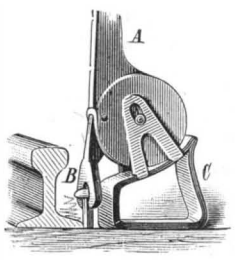
An improvement in expanding mandrels for use in the manufacture of eccentrics, nuts, bands, etc., is patented by Mr. William H. Nicholson, of Wilkesbarre, Luzerne county, Pa., and is shown in the annexed cut. A plain tapered arbor or mandrel adapted to be held between the centers of a lathe has placed upon it a straight sleeve, that is of greater internal diameter than the external diameter of the arbor, and is formed with longitudinal slots. Notched arms are fitted in the slots, and are projected therefrom by the arbor which bears upon them, their outward projection being limited by lugs at their ends, taking hold beneath the sleeve. The arms are tapered on their inner edges to correspond with the taper of the arbor, so that their outer edges shall be parallel with its axis. The outer edges are formed so as to be adapted to the work they are to hold, and by forcing the tapering arbor, endwise, the arms are projected so as to take frictional hold of the work, and by forcing it in the opposite direction the work is released. This mandrel is peculiarly adapted to holding the various kinds of work for which expanding mandrels are used.



Railroad Spike Extractor.

Messrs. William B. Turner, of Long Island City, Queens county, N. Y., and Albert P. Prout, of Woodhaven, same county and State, have patented a new and improved claw-bar for drawing railroad spikes, which is shown in the annexed engraving.

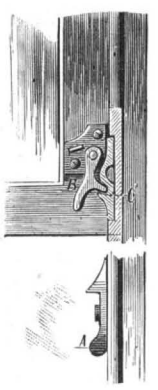
A is a lever whose lower end is enlarged eccentrically, and is slotted edgewise or from front to rear to permit the claw, B, to swing freely, and to afford lateral bearings to the side arms or supports of the swinging fulcrum, C. On a transverse pin on one side of the eccentric the claw, B, is pivoted so as to hang in a perpendicular line with the handle of the lever. Through the center of the eccentric is passed a rod from whose outer ends is suspended the swinging fulcrum, C, by means of side hangers or supports whose eyes are slotted so that the fulcrum may adjust itself in suitable position as a bearing for the lever, A. The claw-bar may be applied to spikes between contiguous rails, where great difficulty is experienced in applying an ordinary claw-bar, by resting the lower edge of the eccentric on the top of the rail; with the bar, A, inclined slightly rearward, the claw may easily grasp the spike, and by motion of the lever drawn, the swinging fulcrum resting unused on the outside of the rail.



Sash Fastener and Holder.

We find among recent inventions a new sash fastener and holder that is automatic, and so constructed that it is not necessary to hold back the latch with one hand while raising and lowering the sash. It is shown in the annexed cut, and is patented by Mr. Harry Greenfield, of Harrison, Hudson county, N. J. The device consists of a locking catch, A, a holding catch, B, and holders, C, of which there may be two or more secured to the frame of the window for holding the window at different heights.

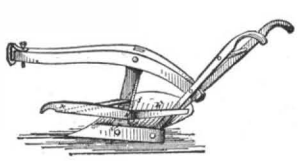
The locking catch is formed with a cam projection, and is loosely pivoted to a lug formed on a plate screwed to the window frame. The holding catch, B, is formed at its lower end with a rounded nose and a finger lift, and is loosely pivoted to a plate secured to the sash by suitable means, and the holder, C, is formed with an overhanging deflector, under which is a detent to receive the nose of the catch. The plate of the holding catch is secured to the sash is such position that the nose of the catch will ride on the window frame, and when the sash is lowered it will ride over the projector of the locking catch and drop under it and lock the window, and when the sash is raised will drop into the detent of the holder and support the window.



AGRICULTURAL INVENTION.

A New Plow Attachment.

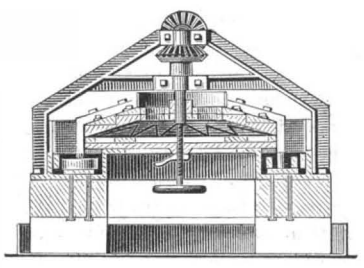
Mr. Thomas P. Wise, of Gravel Hill, Buckingham county, Va., has patented a new and improved attachment to be secured to the land side of a plow, which will cut away a slice of surface of the soil, between the plow and the plants to be cultivated, removing the grass and weeds and carrying them into the furrow in the rear of the plow. The standard of the plow is of ordinary construction, and is provided with a series of recesses and holes, to which an inclined horizontal cutting blade provided with a shoulder on its inner end and a threaded screw may be attached by a corresponding nut, and may be adjusted up or down as desired. The blade may be cast so as to be slightly elevated at its outer end when attached to the standard. The cutting edge of the blade projects out forward beyond the upper edge of the mould board and in line therewith. A wing is firmly secured to the outer end of the blade at right angles to it and parallel to the land side of the plow, and at its rear end is bent inwardly. The front end of the wing is provided with a downwardly projecting hook, adapted to run under vines and cause them to ride over the upper edge of the wing, the rear bent end carrying them into the furrow. The invention is shown by the annexed cut.



METALLURGICAL INVENTION.

Ore Grinding Mill.

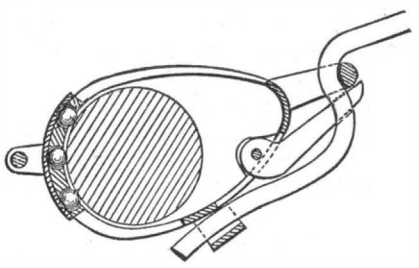
Mr. William E. Harris, of New York city, has invented and patented an improved ore grinding mill, by which the grinding and preparation of ores of all kinds is greatly facilitated. The accompanying engraving shows the construction of the mill. To the upper part of the frame of the machine is attached bearings, in which revolves a horizontal shaft, having upon its outer end a fast and a loose pulley. To the inner end of this shaft is secured a bevel gear wheel, which meshes into the teeth of a bevel gear wheel placed upon the vertical shaft, and connected with it by a slot and feather so that the gear wheel will carry the shaft and also allow it to move up and down freely. The bevel gear wheel is kept to its place by the collar attached to the frame. To the lower end of the shaft is secured the upper grinding plate, which is strengthened by a plate bolted to its upper side and to which is attached the hopper to receive the ore. The lower face of the upper grinding plate is made conical, and has V-shaped grooves dressed in it to facilitate breaking the ore. The face of the lower grinding plate has radial grooves formed to operate in connection with the V shaped grooves in the upper grinding plate. The lower plate is bolted to a strengthening plate which is bolted to a ring flange formed around the upper inner edge of the ring trough. To the upper side of the strengthening plate are bolted angular arms, the lower ends of which project into the trough and have their lower ends rounded to serve as journals for the ring plates placed within the trough and resting upon a lining plate attached to the bottom of said trough. To the inner surface of the outer sides of the trough are also bolted lining plates, against which the outer sides of the ring plates work. The lining plates of the trough are dressed with grooves. Through a screw hole in the strengthening plate passes a hand screw upon which rests the lower end of the upright shaft. With this screw the upper grinding plate may be adjusted at any desired distance from the lower plate, as the character of the ore may require. As the ore is fed into the hopper it passes between the grinding plates and is crushed, and fed outward by centrifugal force, and escapes into the trough, where it is further ground, the pulverized ore escaping through a screen into a receiver.



MISCELLANEOUS INVENTIONS.

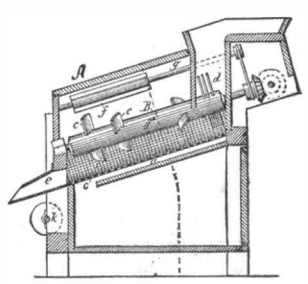
Shaft Loop for Harness.

Among the recently patented novelties is a new shaft loop for harness saddles, that is so constructed that the shafts of the wagon can slide through it very easily, and at the same time is more durable than those in use heretofore. It is clearly shown in the engraving. A buckle frame is rigidly formed to the upper end of the shaft loop of a harness saddle, and the tongue of the buckle is rigidly pivoted to the side of the loop. The lower part of the loop is provided with a series of recesses in which balls are placed, which are held in the recesses by a plate fastened on the under outer side of the shaft loop, and they project slightly from the inner surface of the loop, so that the shaft will rest on them and they will revolve as the shaft passes backward and forward through the loop. By providing the shaft loop with an anti-friction bearing for the shafts the defects of the ordinary shaft loop are avoided, for if there is no friction between the shaft and the loop to move the latter, there will be no chafing of harness or animal. With this bearing for the shafts the buckle of the loop need not be pivoted, but may be made rigid, and will be stronger than the ordinary method. This device is patented by Mr. Peter Casey, of Providence, Providence county, R. I.



Improved Cotton Whipper.

A new and improved device for whipping and cleaning cotton was recently patented by Rose H. Goldsmith, of Charleston, Charleston county, S. C., and is illustrated by the accompanying engraving. A is a box of oblong form and has an inclined bottom formed of wire cloth. At its upper end is a feed spout, in which is placed the cotton to be whipped, and a shaft, B, carrying whipper arms that are arranged spirally around it and extend nearly in contact with the rounder wire bottom of the box. On the upper end of the shaft, B, and within the spout are arranged arms that carry the cotton from the spout into the box, and at the lower end of the shaft is a delivery opening and spout. Parallel to the shaft, B, and above it is a shaft, on which is a roller provided with longitudinal blades, and the shafts are connected by a belt and pulleys, while the shaft, B, is provided with a bevel pinion, which



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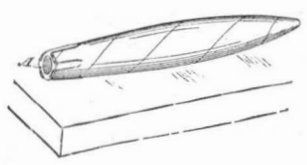
meshes with a similar one on a cross shaft that is driven by a belt from a main shaft.

The cotton is placed in the spout and carried by the feed arms into the box, where it is thoroughly separated by the whipper arms and carried to the delivery end without cutting the staple. The dust escapes through the wire cloth bottom, while the roller serves to press the cotton against the whippers.

Cigar Lighter.

A novel cigar lighter, by which the use of matches for lighting cigars is dispensed with, and that is attached easily and rapidly, and is readily and cheaply made, is patented by Mr. Alfred C. Moss, of Allentown, Lehigh county, Pa., and is shown in the accompanying engraving. A is an inflammable wafer made of the igniting compound ordinarily used on friction matches. To the wafer is attached wings made by cutting out a cross of paper, and they are cemented to it by placing the wafer when in a molten condition in the center of the cross, and as soon as it has cooled the wings will be found to be firmly attached. The wafer is placed against the end of the cigar, and the wings are bent over on the sides of the cigar and secured by some suitable adhesive material applied on the wings, thus holding the wafer firmly on the cigar. By rubbing the wafer over any suitable surface the friction produced will cause ignition, and the cigar will be lighted. No deleterious gases are drawn into the cigar, and the end is not cracked or broken, but rather strengthened by the wafer wings.



Improved Blacksmith's Hammer.

Mr. Martin M. Fish, of David City, Butler county, Nebraska, has patented a mechanical striker for blacksmiths' use, to be operated by the foot. It is so constructed that a powerful blow may be given with little exertion, and it may be set to suit any position of the anvil, and will strike a square or diagonal blow as may be desired.

The accompanying engraving shows the devices by which these results are accomplished.

The standard is formed with a socket at its upper end, provided with a threaded opening at its bottom, through which the threaded shank of the head passes. This head is forked, and between the upper ends of its arms is journaled a shaft having a socket near its center, in which the handle of the sledge is placed. The socket is made larger than the handle so as to admit the thimble, which is perforated circumferentially with holes, in which are placed set screws for holding the sledge in the socket, and for adjusting it so that the face of the sledge will deliver either a flat or diagonal blow.

Secured upon the shaft between the arm and the handle socket is a pulley which is connected with the foot lever by a chain. Attached to the shaft is a coil spring of sufficient strength to raise the sledge to a vertical position and retain it after it has been brought forward by pressure of the foot lever to deliver the blow. Back of the sledge is placed a curved spring, fastened to the frame and supported near its center by a brace. This spring is used to overcome the momentum of the sledge (given by the coil spring on the shaft) after it arrives at its vertical position, and it converts this backward force into power for increasing the force of the next blow of the sledge. Only a light pressure, aside from this force, is necessary to be applied to the pedal to deliver a succession of effective blows. By this ingenious device the workman, with slight additional expenditure of force, becomes both blacksmith and helper.

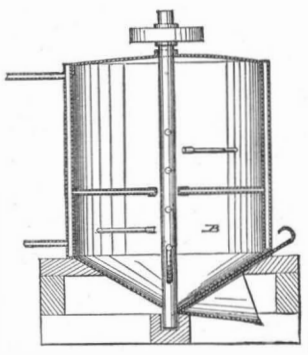
Thread Holder and Cutter.

Among recently patented novelties we find a thread holder and cutter, invented by Mr. Fred. S. Williams, of New York city, the object of which is to cut the thread unwound from a spool and also to prevent the unwinding after the thread is cut. The device is shown in the annexed engraving. A rod, A, adapted to pass into the hole in the center of thread spools, has at its inner end a screw-threaded hole, and at its outer a head. A plate that has a screw-threaded projecting stem is passed into one end of the hole in the spool, and the rod, A, in the other end, when the stem and rod are screwed together, holding both parts in the spool. A strip provided with a longitudinal slot at one end has the opposite end bent to form a hook, and in the central part of the hook is fastened a spring clamp, formed of two flat pieces of spring material resting together. This strip, in connection with a a washer and washer spring, is placed between the head of the rod, A, and the end of the spool. The head of the rod is provided with a small knife securely fastened to it. The thread is unwound from the spool and passed through the spring clamp, or under the washer at the end of the spool, that hold it firmly and prevent it from unwinding. The part that is unwound is passed around the head of the rod, A, and pulled, when the thread is pressed against the knife and cut.

Grain Cleaner.

A simple and practical device belonging to that class of apparatus in which grain is cleaned by stirring it in a cylindrical or other shaped vessel, by means of arms attached to a rotary shaft, has been patented by Messrs. Jack. M. Shackleford and John W. K. McClure, of Blue Mound, Macon county, Ill., and is shown in the annexed cut.

The working parts of the apparatus are supported by a frame of any suitable description. B is a cylindrical vessel having a funnel-shaped bottom and provided with hollow arms extending toward its center. These arms consist of pipes having their outer ends open and their inner ends closed by caps. Surrounding the vessel, B, is a casing, between which and the vessel is an annular steam chamber, communicating with the above described pipes. The chamber has an inlet pipe near its lower end and an outlet near its upper end for supplying it and the arms with steam to keep them hot. In the center of the vessel, B, works a vertical shaft, the lower end of which is stepped in the supporting frame, and the upper end is provided with a pulley. This shaft carries a number of radial arms that are arranged to work between and above and below the hollow arms. In the bottom of the vessel is a slot with a sliding gate, and underneath is a spout leading to a receptacle. The grain is placed in the vessel, and is cleaned by the stirring arms when the shaft is rotated, after which it passes out through the slot, the size of the opening being regulated by the gate. By surrounding the vessel with a steam-tight jacket, and making the hollow arms steam-tight, all the advantage of heat from steam is obtained without the disadvantage of the moisture imparted by the steam, when it is allowed to come in contact with the grain.



Wine Analysis.

BY PROFESSOR L. ROESLER.

QUANTITATIVE ANALYSIS.

1. *Specific Gravity.*—The most accurate results are obtained by the use of Sprengel's pycknometer, or specific gravity bottle. For practical purposes it suffices to use a hydrometer carefully graduated and compared. Before every operation it must be carefully washed with water and alcohol and kept in a case to protect it from dust.

2.—*Percentage of Alcohol.*—The simplest way is to take 100 c. c., or, better, 200 c. c., and distill off two-thirds, then dilute the distillate to the original volume and take its specific gravity. As some acetic acid distills over, it is well to add 50 c. c. of lime-water and 50 of water to the first distillate, and then distill off 100 c. c. The percentage of alcohol is just half of that corresponding to the gravity found. In wine that foams much add 0·2 per cent. of tannin.

3. *Extract.*—If this is found by evaporation to dryness on a water-bath, the results will be too low, because the glycerine goes off and some of the extract suffers decomposition. A temperature of 80° C. (176° Fahr.) must not be exceeded; or the drying is done in vacuo. The best way is to put the wine in a stoppered vessel on a sand-bath at 60° C., and put this under the receiver. The extract can be found from the specific gravity of residue left after the alcohol has been distilled, by means of Balling's tables.

4. *Free Acid.*—This is best determined by titration with a potash solution of such strength that the number of cubic centimeters required to neutralize 10 c. c. of wine will give the grammes of tartaric acid in a liter of wine. To determine the cream of tartar, 10 c. c. of wine is treated with 50 c. c. of alcoholic ether, and left to stand for twenty-four hours, and then filtered, and the bitartrate washed out with alcoholic ether, then dissolved in boiling water and titrated with potash solution. The free tartaric acid is found by neutralizing 10 c. c. of wine with the above potash solution, mixing with 40 c. c. of wine, and then estimating the cream of tartar in 10 c. c. of the mixture, as before described. Of course, the quantity of potash added to 10 c. c. must here be taken into account.

5. *Tannic Acid.*—This may be estimated by Neubauer's modification of Loewenthal's method. The alcohol is first expelled from the wine, and the residue restored to its original bulk, and then titrated with permanganate of potash and indigo carmine. Since there are other things in wine which will reduce the chameleon solution, it may be first shaken with pure bone-coal before titrating.

6. *Acetic Acid.*—The Kissel-Neubauer method is employed, 50 c. c. of wine being rendered slightly alkaline with baryta water, the alcohol evaporated, the precipitate filtered out, and phosphoric acid added to the filtrate. This is repeatedly distilled, replacing the water that goes over. These several distillates are united and titrated. Weigert distills 50 c. c. wine on a salt-water bath, under reduced pressure, and repeats the operation after adding water to the residue.

7. *Sugar.*—The wine is first decolorized with bone coal, or acetate of lead, and the titrated with Fehling's solution. Either the original wine can be taken, or a solution of the extract, for alcohol has no effect upon the Fehling copper solution.

8. *Glycerine.*—According to Neubauer and Reichardt 100 c. c. of wine is evaporated to one-third in a porcelain dish, slaked lime enough added to make it alkaline, and then evaporated to dryness. The residue is extracted by boiling it with 90 per cent alcohol, evaporating the solution to dryness, dissolving in alcohol again, and then adding ether. If any precipitate forms, filter it out and let it evaporate spontaneously.

9. *Nitrogenous Matter.*—Vegetable albumen and gelatine are only present in small traces. To estimate them, evaporate 10 to 20 c. c. of wine in a very thin glass dish, pulverize them together, and burn them, as in the Will and Varrentrapp method.

10. *Ashes.*—Evaporate 50 or 100 c. c. of wine in a very capacious platinum dish, drying, and burning at a low red heat. The separate constituents of the ash may be determined in the usual manner.

QUALITATIVE ANALYSIS.

So many methods have been given for detecting coloring matter that we cannot mention them all here. As a general thing, if a red wine is not decolorized by nitric acid it is genuine. If it is decolorized this is no proof of genuineness.

Polarization is a sufficient test for potato or starch sugar. If the rotation in a 200 c. c. tube in Wild's polariscope exceeds 1° to the right, grape sugar is present. Pure wine only rotates the light from + 0·1° to + 0·3°. Polarization is also used to test for cane sugar. For this purpose 50 c. c. of wine is mixed with 5 c. c. hydrochloric acid and heated ten minutes to 70° C. and read, the reading being increased one-tenth for the dilution with acid. If it rotates more to the left after than before, cane sugar is present.

Salicylic acid is tested for in wine free from tannin only by extracting with ether. Tannin is not soluble in carbon disulphide, while salicylic acid is soluble, although not very. Hence equal volumes of wine and disulphide are shaken together, and the latter tested with perchloride of iron solution.

To test for sulphurous acid 50 c. c. of wine is distilled with careful cooling until 3 c. c. comes over. The distillate gives a white precipitate with nitrate of silver, soluble in nitric acid.

It is important to test for *inosite*, because it is present in all natural wines, but owing to its cost is not used in making artificial wines. In making this test at least half a liter of wine is precipitated with sugar of lead, filtered, and acetate of lead added. The precipitate is washed out, then suspended in water and decomposed with sulphydric acid, again filtered to remove the sulphide of lead, and the filtrate evaporated to the consistency of a sirup, and then treated with four times its volume of absolute alcohol, At the end of twenty-four hours the resulting residue is dissolved in water, decolorized with charcoal, and the solution evaporated to dryness. If inosite is present this residue will give a pink coloration with a drop of the nitrate of mercury solution.

Arsenic may be in the fuchsine used to color wine; heavy metals like lead, copper, mercury, and zinc may get in accidentally or be introduced intentionally. They are detected in the usual manner.—*Chemiker Zeitung, No.* 16.

Progress of Domestic Comforts.

Among the recently granted patents is one for the cooling of dwelling houses, offices, hotels, etc., by means of compressed gas, which is conducted from a street main into the premises in pipes like ordinary gas. The compressed gas on being allowed to expand within a suitable receptacle, produces a very low temperature. Thus the housekeeper, simply by turning the gas faucet, will be able to make ice, supply the dwelling in hot weather with cold air, and produce all forms and degrees of refrigeration with the utmost facility. Our houses being now supplied from street mains with cold water, hot water, compressed gas, and electricity, we now only need, to complete the comforts of living, a milk main and tea and coffee mains; after which perhaps the public will call for soup pipes.

The Transit of Venus.

Already about forty expeditions have been projected for the observation of the coming transit of Venus. The number will be considerably increased by those of the United States, Italy, and Austria, yet to be announced. The French have fixed upon eight stations: In the north, Florida, Col. Perrier; Cuba, M. d'Abbadie; Mexico, M. Bouquet de la Grye; Martinique, M. Tisserand. In the south, Santiago du Chili, M. Leclerc; Santa Cruz, M. Fleuriais; Rio Negro, M. Perrotin; Port Desiré, or Chubutt (Patagonia), M. Hatt. These missions will start in July. Each will have two equatorials, one 8 inch and one 6 inch.

A ROAD locomotive for war purposes, lately tried, weighed 28¾ tons, and drew easily 40 tons weight of guns mounted on their carriages fully equipped. Its maximum traction power is 150 tons, and its cost of maintenance is about 30 cents an hour.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

ATLANTA, GA., Dec. 24, 1881.

H. W. Johns M'f'g Co., 87 Maiden Lane, New York.

DEAR SIR.— . . . The warehouse (300 x 300) in Columbus, Ga., covered with your roofing, ordered by Col. W. L. Salisbury, some ten years ago, is now apparently as good as new. Yours truly, J. T. WARNOCK, M.D.

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Cope & Maxwell M'f'g Co.'s Pump adv., page 268.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

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4 to 40 H. P. Steam Engines. See adv. p. 285.

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For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 304.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 305.

Steam Pumps. See adv. Smith, Vaile & Co., p. 306.

Common Sense Dry Kiln. Adapted to drying of all material where kiln, etc., drying houses are used. See p. 306.

Ball's Variable Cut-off Engine. See adv., page 286.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Drop Forgings of Iron or Steel. See adv., page 326.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

Paragon School Desk Extension Slides. See adv. p. 324.

Brass & Copper in sheets, wire & blanks. See ad. p. 325.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

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Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 326.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Latest and best books on Steam Engineering. Send stamp for catalogue. F. Keppy, Bridgeport, Conn.

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For Mill Mach'y & Mill Furnishing, see illus. adv. p. 324.

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Patent Key Seat Cutter. See page 325.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) K. C. writes: We nickel plate small steel goods, and the articles, when taken from solution, are black, and the anodes red. The articles are highly polished before plating, we think they should be nearly so after plating. We have a 6 gallon solution and 4 Smee batteries, zinc plates 5x8 inches, and 50 square inches of anodes. What is the cause of the articles being black? A. See "Nickel-plating," in SUPPLEMENT, No. 310.

(2) C. M. R. asks: How is the hard, smooth, black finish put on wooden handles such as are used on dinner pails? It looks as if they had been dipped, and it must be cheap. A. See "Japans and Japanning," SCIENTIFIC AMERICAN, Vol. xlv., No. 10.

(3) N. S. C. asks: What must I do to prevent the gelatin of my printing pad from peeling off and adhering to the paper? A. Use more gelatin and a little soap.

(4) W. G. N. asks: Why is not a pulley that is in balance when standing still in balance when in motion? A. Because of unequalized centrifugal force.

(5) J. H. C. writes: We have some interest here about the following question: Is the pressure as great on a tank 5 feet long, 4 feet high, and 6 inches wide, as it is on a tank 5 feet long, 4 feet high, and 2½ feet wide? A. Pressure per square inch is the same in both cases if the water be maintained at the same height.

(6) A. D. F. asks: 1. Which is the best style of steam engine for a small lathe, sewing machine, and work requiring about half horse power, oscillating, vertical, or horizontal? A. Vertical direct acting. 2. What size boiler will it take to run an engine 2 inches diameter by 4 inches stroke? A. It depends upon the amount of power you wish to obtain from the engine. 3. Which is the best style of boiler? A. Vertical tubular. 4. Do you give full directions and illustration for building the above in any of your papers? A. There can be no such directions given that will supply the place of experience. 5. How can I make a cheap and simple attachment to my foot lathe slide rest to make it feed automatically? A. Use a "star" wheel on the screw of the rest, and operate by a clamp or "dog" on the work.

(7) W. J. F. asks: 1. What is the process for silvering glass specula? A. For the process of silvering glass see SUPPLEMENT, No. 224. 2. Are astronomical oculars ever constructed on the principle of the compound microscope? A. The eyepieces for microscopes and telescopes are alike in optical construction, for general observation, and are of the type long known as the Huygheus eyepiece. For special work, as for micrometers, a Ramsden eyepiece is used for its value in giving a flat field. 3. I have heard lately that a Georgian has discovered a method for the manufacture of telescope lenses from the "virgin drip" of rosin. What is this virgin drip? A. Virgin drip lenses can be nothing more than lenses made from pure clear rosin, which can be ground and polished like glass, but is too frail to be of any value in optical work. Small single lenses have been made by placing a drop of melted rosin or Canada balsam in a hole in a thin piece of metal; the fluid, assuming a globular shape and drying, becomes a tolerable lense where no better can be had.

(8) E. B. C. writes: I want to have the discharge pipe of a large force blast blower connected with the smoke stack in order to get rid of the fine dust discharged by the blower. Suppose the smoke stack to be 5 feet diameter, and 100 feet high, and the discharge pipe from the blower to be 18 inches, and enter the stack say 50 feet from the breeching, what effect will it have upon the draught? Also, say, 35 feet and 65 feet. My theory is that at 35 feet it will retard the draught materially, but at 65 feet have a tendency to increase it. A. If the end of the blower pipe is turned up, and the velocity of the blast is greater than the velocity of the natural draught, the draught will be increased in every case. 2. Why is it that in looking from the underside of two 13 inch saws revolving at the rate of 2,500, the further one of the two has the appearance of just revolving, say, not to exceed ten revolutions per minute? In looking over the top side there is nothing of the kind to be seen. The same is noticeable in looking at two revolving pulleys. Looking horizontally through the arms the further of the two has the appearance of just revolving, while the near one is at good speed. A. It is due to the interruption of the light by the teeth of the first saw. You see the teeth of the second saw in a rapid succession of positions which advance slowly and give the appearance of a slow revolution. The zootrope illustrates this principle.

(9) H. C. P. asks Will you give me a receipt for preparing a sail so that it will not mildew? A. See "Waterproofing," page 91, vol. xlv.

(10) A. D. asks: Will you please inform me concerning the idea of and the latest machinery employed in making what the people now call washing blue? A. There are quite a number of laundry blues in the market; some of these are composed of ferric-ferrocyanide, or Prussian blue rendered soluble by a slight excess of potassium ferrocyanide or oxalic acid; others are simply aniline blue (soluble), indigo sulphate, or ultramarine blue.

(11) C. C. G. asks: 1. What are the proper curves for tools to grind a crown double convex lens, and a flint plano-concave lens for an achromatic telescope of 4½ inches aperture and 66 inches focus? A. The curves for objectives cannot be given with any degree of exactness without knowing the refractive and dispersive power of both kinds of glass that you intend using, as this is of the utmost importance in assigning the curves of four surfaces for both chromatic and spherical aberration. If this is to be your first trial, it will also have to be your school. Assuming that your glass is of medium density, and that you intend, as you state, to make the last surface plane, you may make the pair of laps 24 inches radius. Grind and finish ready for polishing the first three surfaces and the last surface plain, then polish perfectly the first and last surfaces; half polish the second and third surfaces, and put the glasses together in their cell with glycerine, and make a trial for correction. If found under correct, deepen the central curves, altering the lap to 23 inches or 22 inches radius, regrinding and half polishing as before, and repeating if necessary until you are satisfied with the performance of your glass; then polish the inner surfaces and cement with Canada balsam. The other plan of proceeding, as practiced by the Clarks of Cambridge, was to make the first, second, and third curves alike, and alter the last surface for correction. We do not recommend this plan for a beginner, as the haziness of the image from a half polished surface will mislead your judgment; and it also increases the labor on the last surface if you finish it for each trial. 2. Has any article been published in SCIENTIFIC AMERICAN on grinding lenses? A. For article on grinding lenses we refer you to SUPPLEMENT, No. 141.

(12) J. B. B. writes: 1. I am compelled from disability to use a wagon to travel on, but am not strong enough to run it on an ordinary road, and am trying to devise a motive power to propel a road wagon large enough to carry two persons, as I am obliged to have an attendant when I go from home. As I cannot find the information desired in any book at hand, what size engine, bore, and stroke, at 100 pounds boiler pressure, would it require to propel a road wagon of light build, to carry two persons whose gross weight is not over 300 pounds, at speeds ranging from two miles, going up ordinary hills, to ten miles on ordinarily level roads in fair condition? A. Quite small engines could be used, gearing to the drivers or by using small driving wheels. We could not give size without more data. 2. Is it practical to use benzine or naphtha in a boiler in place of water to generate power to drive an engine? A. Benzine, naphtha, and all kindred volatile liquids are too dangerous. 3. Would an engine driven by gas, same as by steam, produce as good results, and the difference in cost of running ten hours? A. A gas engine could not be used—takes too much room and is too heavy. We advise that you obtain and study the English experiments with road engines in "Gordon on Locomotion," and "Steam Power on Common Roads," by Young.

(13) F. N. F. writes: I have a couple of meerschaum pipes which are nicely colored, but when they are smoked the tobacco oil oozes through the pores in large beads and renders them disagreeable to handle. Can you inform me, through your Answers to Correspondents, how to remedy the evil? A. The pores of the substance may be filled by digesting it for several hours in a warm sirupy solution of waterglass, and then allowing it to dry thoroughly in an oven or otherwise.

[OFFICIAL.]

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May 2, 1882,

AND EACH BEARING THAT DATE.

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A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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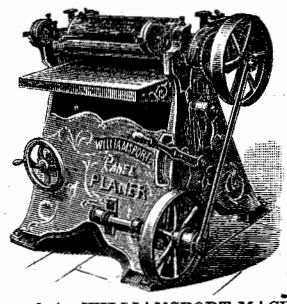

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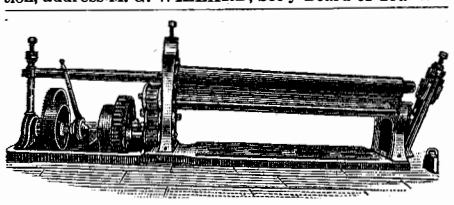

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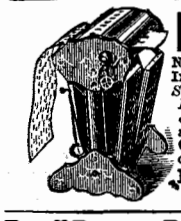

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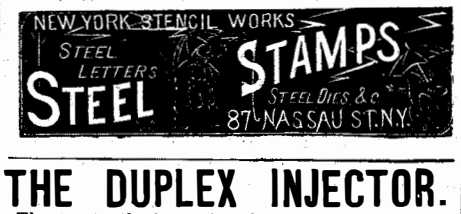

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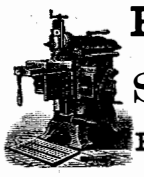

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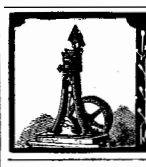

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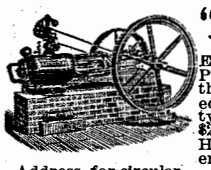

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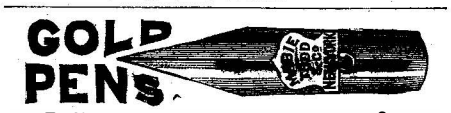

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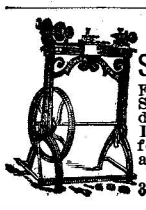

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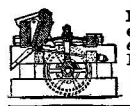

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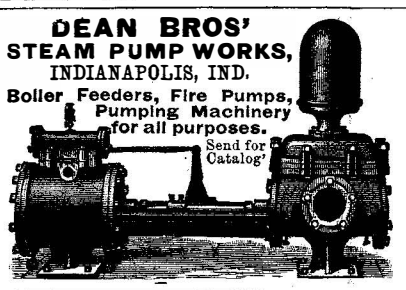

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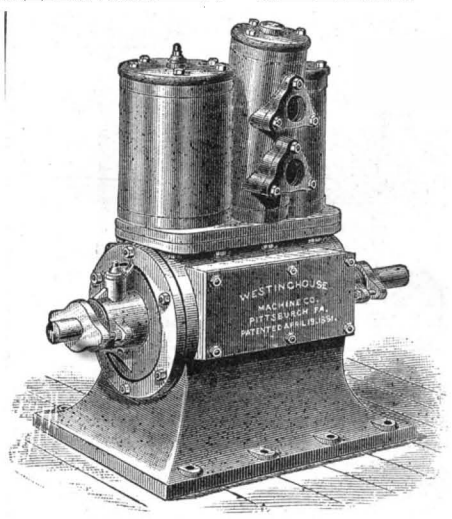

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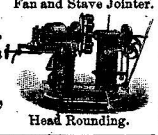

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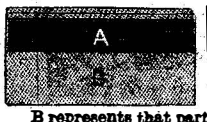

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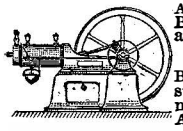

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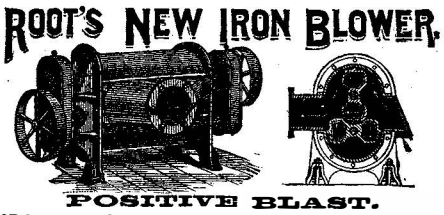

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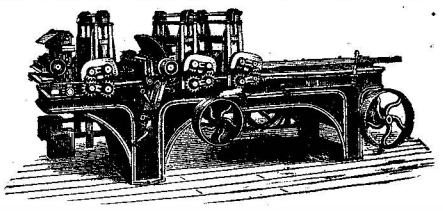

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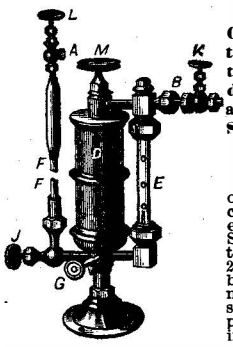

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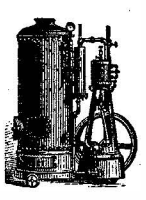

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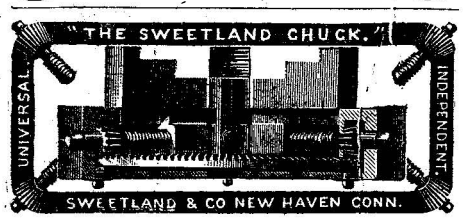

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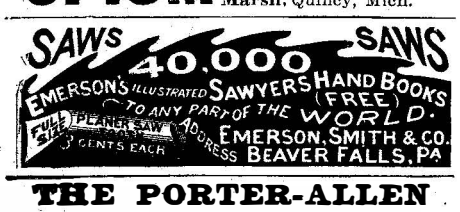
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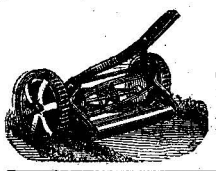

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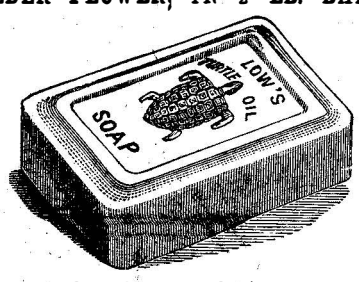

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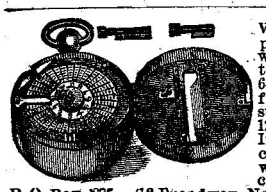

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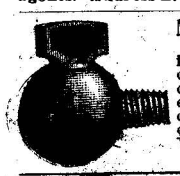

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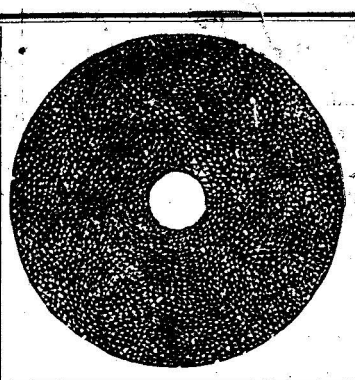

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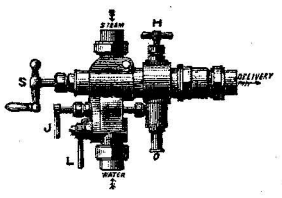

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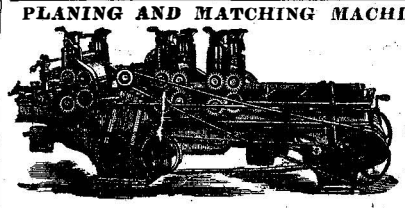

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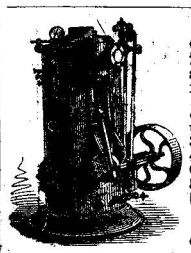

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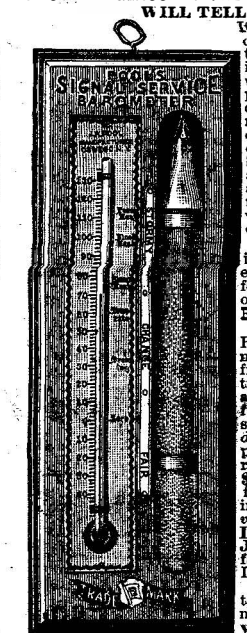
POOL'S SIGNAL SERVICE BAROMETER

Or STORM GLASS and THERMOMETER Combined, WILL TELL YOU!



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